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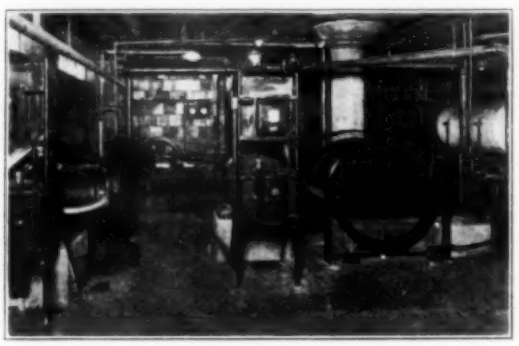
Castings Compress Air for Industry's Needs

COMPRESSED air probably was used thousands of years before the Christian era in the reduction of metals from their ores. Notes of Heron, the old philosopher of Alexandra, show that the use of compressed air in a pump was familiar to the learned men of those days. As civilization progressed, man found many additional uses for compressed air, such as discharging projectiles from guns and supplying fresh air to workmen in deep sea diving. Developments



Air Compressors Have Become A Necessary Part of Many Industrial Establishments

in the iron industry brought many improvements in compressors and a wide field for their application. Today, industry finds compressed air an important factor in satisfying many wants of society. Thousands of operations, which formerly required a great amount of labor, now are performed quickly and easily with compressed air. Machinery powered by compressed air now digs coal in the deep mines, bores through mountains of solid rock to make possible great tunnels, rivets towering masses of structural steel which form skyscrapers, lifts heavy loads, finishes work by sandblasting and performs many other operations. Development of compressors and blowers has kept pace with progress in the application of compressed air. The foundry industry not only is an important user of compressed air, but it casts the parts from which compressors are made.

Find Where Castings Can Be Sold.

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SPINS PIPE

Extensive Buildings and Equipment Were Designed and Erected To Make Gas and Water Pipe According To a Centrifugal Process in an Old Established Pipe Plant

ERECTION and operation of a plant for making cast-iron gas and water pipe by the centrifugal process, latest development in the making of these castings, is a logical step for R. D. Wood & Co., Philadelphia, whose continuous history as prominent pipe makers dates back for a period of approximately 100 years.

The business first was established at Millville, N. J., in 1803. About 1867 another plant was erected at Florence, N. J. At this late date no positive evidence is available, but it seems fair to assume that at least one of the reasons for establishing the first plant at Millville was the character of the molding sand to be had in the vicinity. Old time foundrymen could not translate their knowledge of sand into definite figures indicating chemical analyses, bond, permeability, strength and grain size, but they could squeeze a ball of sand in the hand and shrewdly determine whether it would make a satisfactory mold either in the green or in the dried state.

New Jersey is singularly well supplied with excellent molding sand deposits and perhaps that also may account to some extent for the fact that the state is linked so closely and extensively with the pipe industry. It is claimed that the first cast-iron pipe made in America was cast in New Jersey. At present the state ranks second only to Alabama in value of product and the number of pipe casting plants within its borders.

The pipe shop, built by R. D. Wood & Co., in Florence, still is in existence and pipe still are made in it, although at present and for many years past it only has constituted one small unit in the extensive group of buildings that have grown up with the years and that occupy the greater part of a 54-acre property extending for half a mile along the east bank of the Delaware river. Circular pits still are in use in the oldest building, but they are served by modern traveling cranes in place of the ponderous old wood jib cranes with which they originally were equipped. Improvements

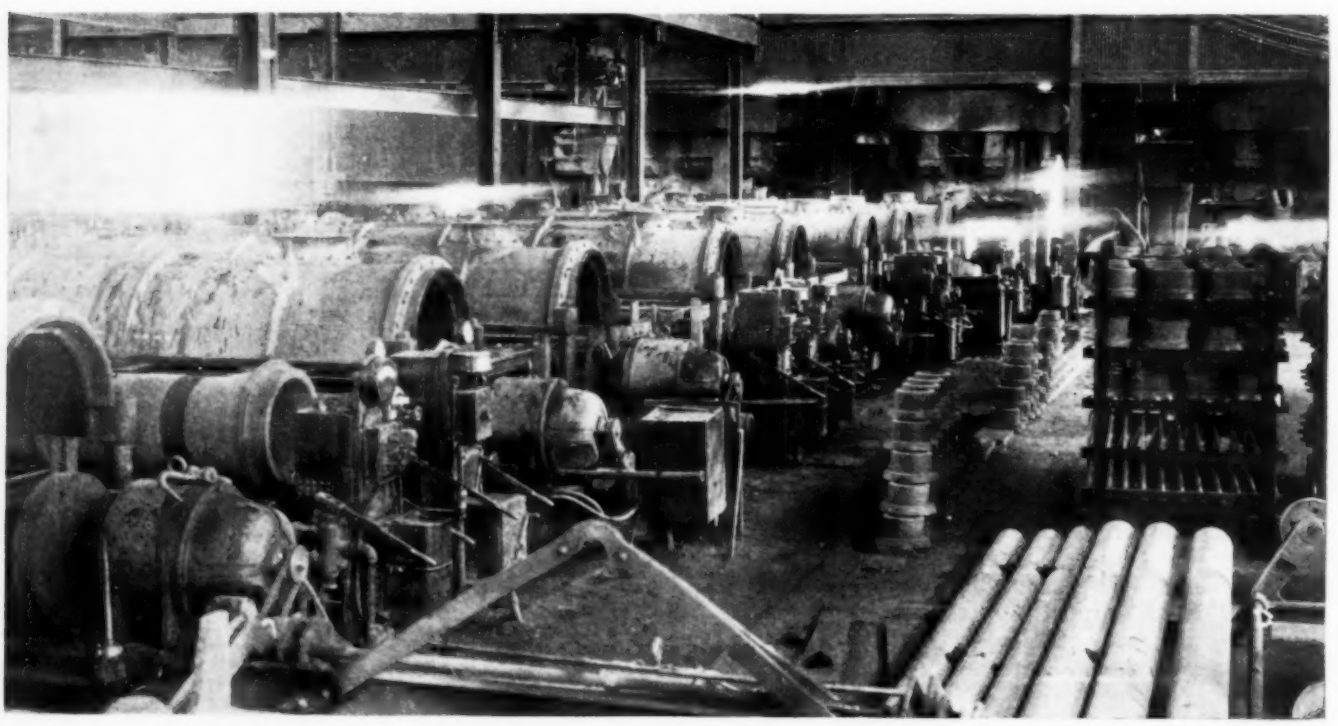


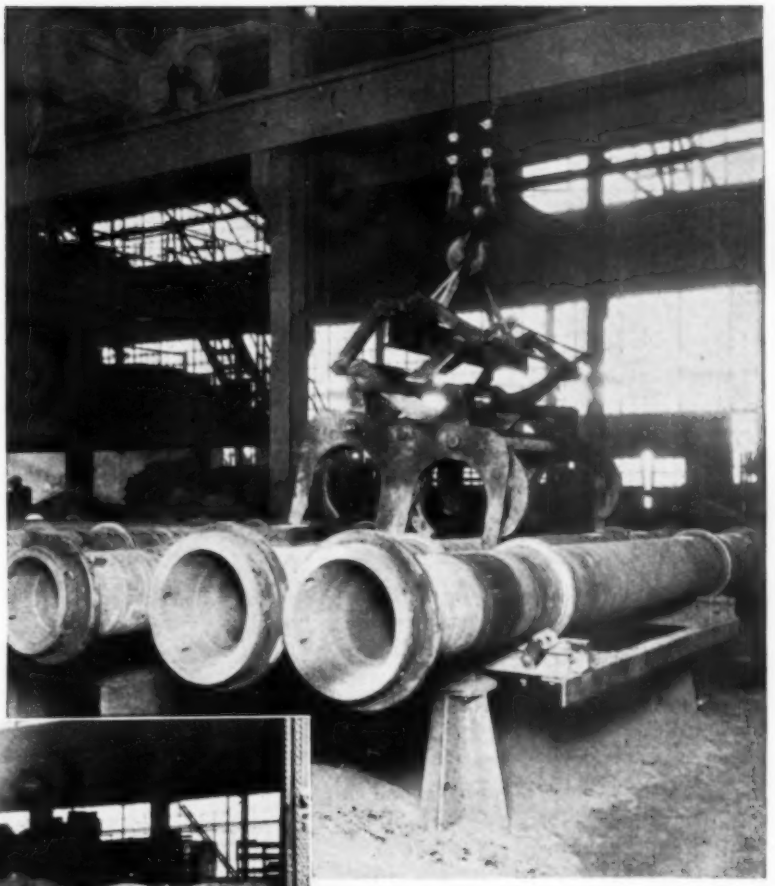
Fig. 1—Eight Pouring Machines Are Operated in a Battery. The Motors Are Arranged to Accelerate in Speed Automatically After Starting and to Stop at a Predetermined Time

in

Iron Molds Lined with Sand

By

Pat Dwyer



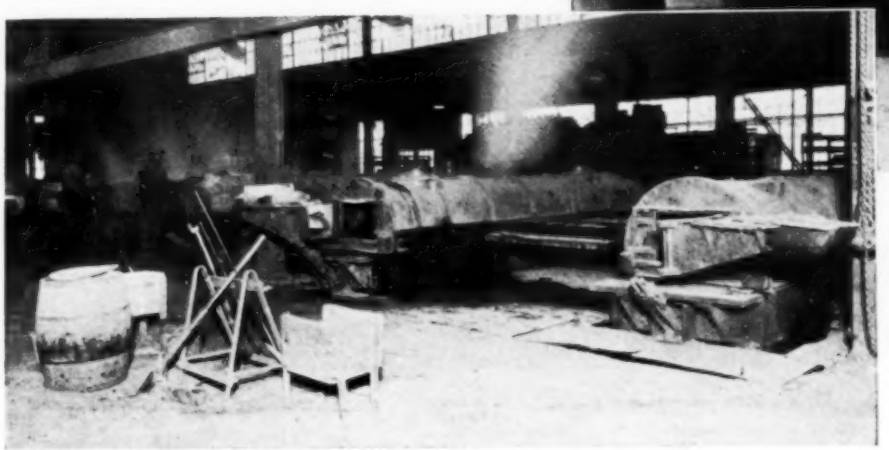


Fig. 2—(Left)—A Pouring Basin Designed to Hold the Exact Amount of Iron Required for a Pipe Is Mounted at One End of Each Machine. Fig. 3—(Above)—An Ingenious Type Double Hook Is Employed to Handle the Flasks

in methods and equipment have been introduced all over the plant from time to time. Improved buildings have been erected and equipped at periodic intervals to meet increased production schedules. Before the new, sand-spun department was added, the production of pipe was given as 80,000 tons a year, exclusive of specials, fittings, hydrants and miscellaneous hydraulic and other heavy machinery castings.

Within the past year the company has erected and equipped a large, modern plant, on land adjoining the old property to the south, for the production of cast-iron water and gas pipe by the centrifugal process in sand-lined, iron molds. This plant has a potential capacity of 400 tons a day when fully equipped and working full time.

Increased strength as shown by transverse and tensile tests is claimed for pipe made by the new method, but pioneering is notoriously slow work. Even the famous mouse trap maker had to possess his soul in patience for some time after he had shipped his first masterpiece, before a clamorous public trampled down all the grass in his front yard beating a pathway from more densly populated centers to his door.

Many advantages are claimed for cast-iron pipe made by the centrifugal process. Weight is reduced, length for length, as compared with pipe cast in the manner which has come to be regarded as standard and orthodox for this class of castings. By the standard method is meant casting in dry sand molds with loam cores and pouring through a ring of pop gates on top while the mold stands in a vertical position in a deep pit.

Of course the principle involved in casting metal by the centrifugal process is not new. Foundrymen on both sides of the Atlantic have been experimenting with the process for over 100 years. The history of the development of the centrifugal process of making castings has served as the theme of numerous papers presented at meetings of foundrymen, in articles in THE FOUNDRY and in writings of others interested in the fabrication of metals. These papers have been published widely and have been incorporated in

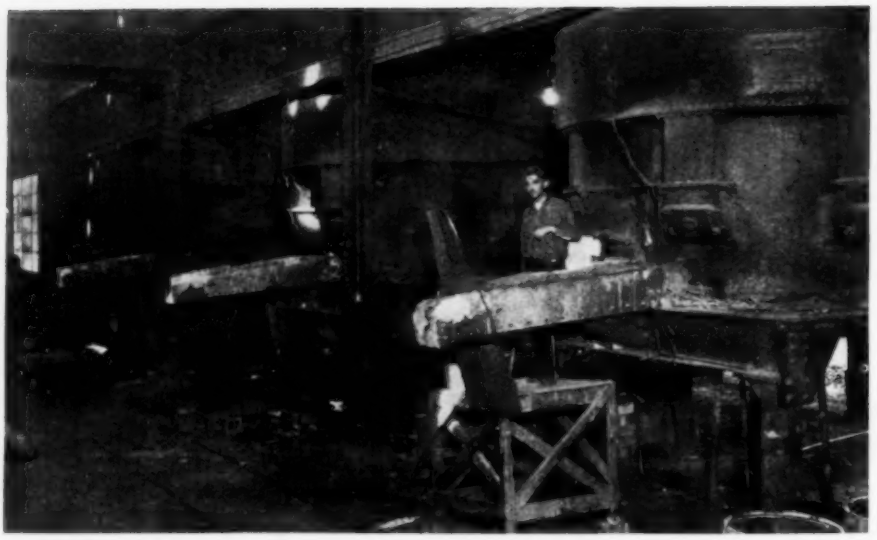


Fig. 4—A Battery of Three 102-Inch Cupolas Is Located at One End of the Building

the written records of the associations before which some of them were presented originally. They easily are available for any person interested in this phase of the subject.

Recent reference may be noted in THE FOUNDRY, July 15, 1927, where John D. Capron, reviews progress in centrifugal casting processes. Other references within the past few years include two articles by E. C. Kreutzberg which appeared in the Jan. 15 and Feb. 1, 1927 issues and two articles by Dan M. Avey, which were published consecutively in the issues of Dec. 15, 1926 and Jan. 1, 1927. The first two authors referred to the deLavaud process in particular in which molten iron is poured into a revolving metal mold. The third dealt in detail with the equipment and methods employed in a plant where sand-lined, iron molds are employed.

A still more recent reference may be found in a paper prepared by J. E. Hurst, published in the Aug. 15, issue of THE FOUNDRY, and presented originally before a convention of the American Foundrymen's association held in Chicago, June 6-10. One of the most interesting features in this paper is the statement that in several British foundries, no subsequent annealing is required for cast-iron pipe made by the centrifugal process in iron molds. The molds are not jacketed for temperature control, but at the same time they are not used while they are cold. After a preliminary heating, presumably by

Fig 6—Molds Are Slightly Skin Dried Before They Are Placed in the Pouring Machine

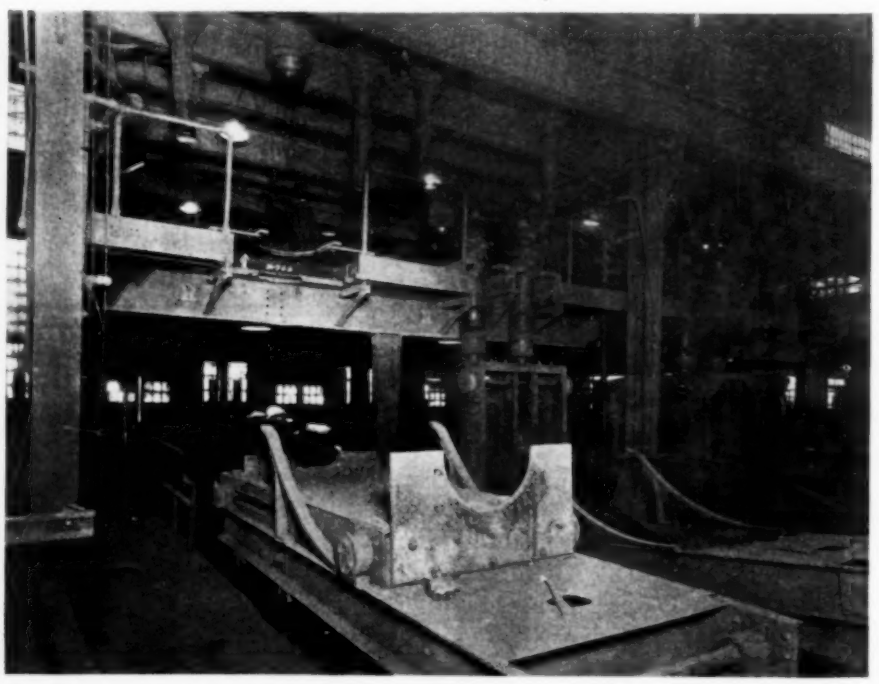


Fig. 5—A Special Carriage Tips the Mold to a Vertical Position on the Ramming Machine

the casting of a few pipe, they are maintained in a heated condition through constant use and the resulting castings, it is stated, are not *chilled.*

Two Main Methods

Both the deLavaud and the sand-spun process are based on the same principle and share many operating features in common. No cores are employed. Centrifugal action throws the molten metal against the wall of a rapidly revolving metal mold. The amount of metal required to form a pipe of any given dimension is calculated in advance. This exact amount is poured into the mold and is distributed uniformly throughout the mold by centrifugal force exerted against the inside surface of the whirling mold. Not the least of the many advantages claimed for this method of making pipe is that no metal is wasted in gates, runner basins and head metal. Also, the castings cannot strain and come out over weight.

Even if the sand face were to yield a trifle it would not affect the weight of the casting. However, this is a far fetched contingency on account of the thin sand lining used in the molds. Of course in the all-metal molds, even this remote contingency is removed from the field of possibility.

The principal point on which the two methods differ is that in one the molten metal is poured against the naked metal face of the mold. In the other the metal rests against a sand lining rammed against the inside face of an iron mold. Castings made according to the first method,

Fig. 8—Castings Are Taken from the Flasks With a Long Steel Bar

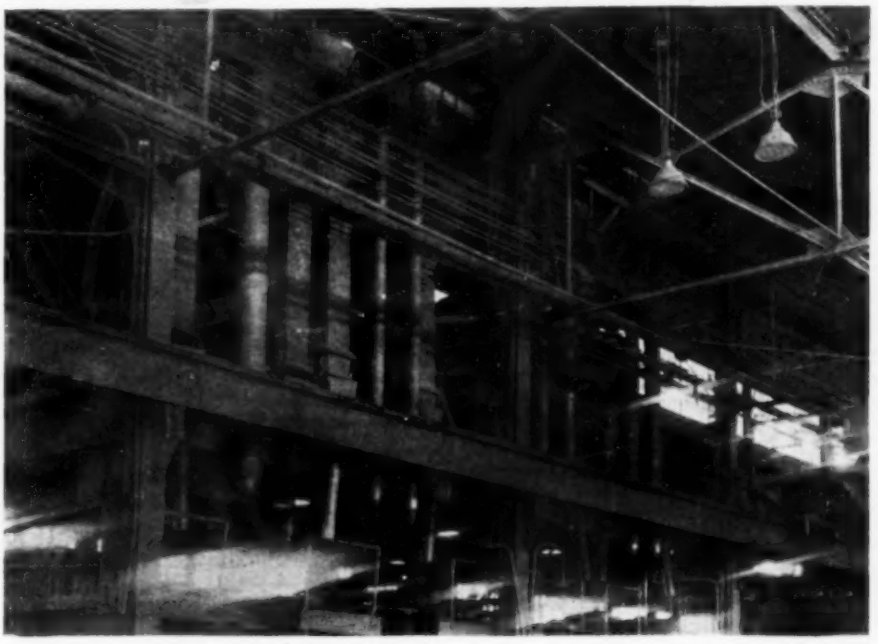


Fig. 7—Metal Patterns for the Pipes Are Suspended by Steel Cables

at least in the installations in this country—are chilled and accordingly are passed through an annealing furnace after they have been taken from the molds. This secondary treatment is not required on castings made according to the second or sand spun process.

Sand Spun Molds

In one method the molds are used constantly without any interior treatment. They are permanent molds in the generally accepted sense of the term, but the castings must undergo an annealing treatment later. In the second method the molds must be relined with sand after each casting is poured, but no annealing treatment is needed afterward.

This second process is the one adopted by the R. D. Wood Co. at its Florence, N. J., plant where a special building has been erected and equipped for the production of cast-iron pipe in 16-foot lengths and in 4, 6, 8, 10 and 12-inch sizes. Other sizes are in contemplation and equipment will be installed for their manufacture when and if conditions warrant the step.

Experience gained over a period of many years in designing and erecting new buildings to meet the requirements of expanding business, served the company's engineering staff in good stead when confronted with the problem of erecting and equipping a building for the production of cast-iron pipe according to a process that had not yet completely passed from the experimental to the commercial stage. The building, 150 x 400 feet, of brick and steel, conforms to the best standards of modern industrial construction. Ample light is supplied through windows that occupy the greater part of the wall area on the sides and ends, also in the monitor roof. Swinging sections in the windows may be manipulated to regulate the ventilation.

A separate building houses the power plant with its generators, pumps and compressors. The casings in which the pipe molds revolve are raised and lowered hydraulically. Compressed air is utilized to operate the jarring machines on which the sand is packed into the pipe molds. Also similar machines on which the sand later on is shaken out of the same molds are operated by compressed air. Each of these machines, made by the Herman Pneumatic Machine Co., Zelienople, Pa., has an 18-inch diameter cylinder, a lifting capacity of 16,200 pounds and is capable of striking 200 blows a minute.

Approximate position of the various pieces of equipment in the sand spun shop is shown in Fig. 9. In addition to showing the position of the various

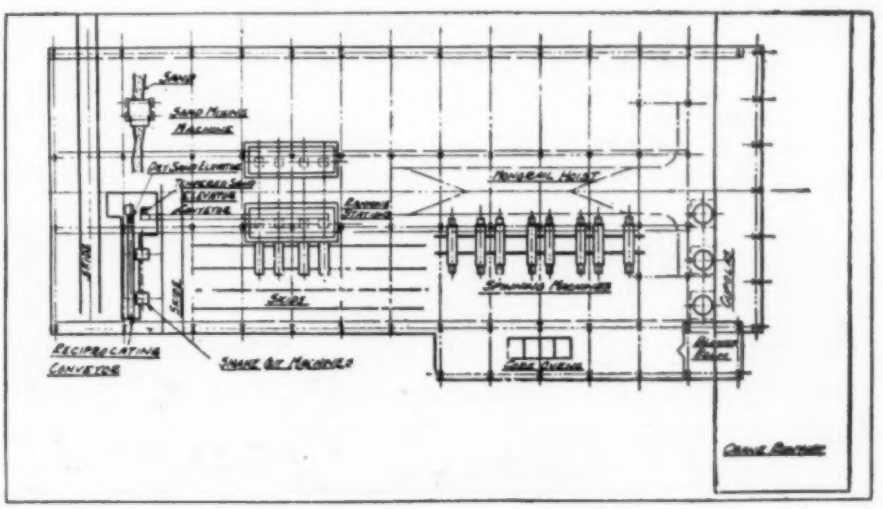


Fig. 9—Drawing Showing Approximate Layout of Equipment in the Sand Spun Shop

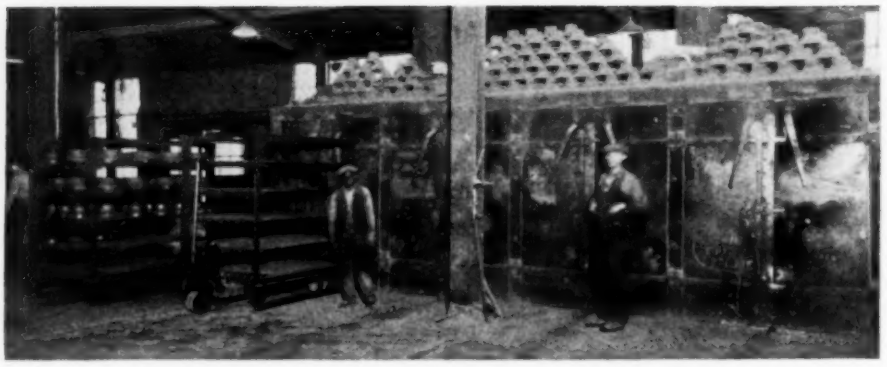


Fig. 10—Core Ovens Occupy Relatively Little Space

units, the drawing shows the route over which the molds pass in their continuous journey which may be said to have no beginning and no end unless the jolting machines under the sand hoppers may be reckoned the beginning of the cycle and the shakeout jolt machines, the end.

On that basis a brief summary of the process would indicate that the molds are rammed in pairs on four jolt machines at the station marked. The blacking is slightly skin dried while the molds are in a horizontal position before they are placed in the pouring machines and then placed on a skidway for approximately an hour to cool. Then they once more are up ended and placed on two jolt machines where the sand is rattled out of them. The castings are placed on a skidway leading to the coating and testing stations and thence to the stock piles in the yard. The sand falls through a grating into a conveyor which lifts it to the floor level where it is reconditioned and once more placed in circulation. The empty molds also are returned to the ramming station and also once more are started on the journey around the circuit.

Another feature which may be noted on the sketch is that only one-half of the floor space has been utilized. Eventually the remaining half of the building will be equipped with a duplicate set of machinery. Three cupolas at one end of the building are designed to serve the present set of casting machines, and a second set will be installed later. A monorail extending across in front of all three cupolas and down both sides of the main central gangway is provided with suitable switches for the transfer of the ladles to any desired point. Each of the cupolas with a 102-inch shell at present is lined to 60 inches inside diameter.

If necessary later, this diameter may be increased to a maximum of 86 inches, but at present with a melting capacity of 15 tons per hour, one cupola melts all the iron required. Eventually, it is planned to use two cupolas steadily and hold one in reserve. The stock yard back of the cupolas is served by a 10-ton crane made by the Harnischfeger Corp., Milwaukee. The molding, pouring and shakeout operations in the foundry are taken care of by three 5-ton cranes made by the same manufacturer. To a certain extent and under exceptional circumstances, the services of the three cranes are interchangeable, but under ordinary conditions one is kept fully occupied over the pouring machines, the second attends the molding machines and the third is kept busy attending the shakeout machines.

Preparing the Sand

Equipment and methods for preparing the sand in this foundry appear to have been held to a happy average. The equipment installed by the Link-Belt Co., Chicago, is sufficient to take care of all the sand required and yet is not so extensive and elaborate as to present any serious hazard from breakdown. To further reduce the chance of one small unit tying up the whole system, preparation of the sand has been divided into three sections. The conveying and distribution is handled by equipment installed by the Link-Belt Co. Actual mixing and reconditioning of the sand is done by a sand cutter made by the American Foundry Equipment Co., Mishawaka, Ind.

A coarse grade local sand is employed for lining the pipe molds. It grades high in refractoriness, permeability and bond and stands up well in service. The bond is renewed by wetting the sand with clay wash. The molds are poured while the sand is green, from which it is apparent that a good, strong sand must be rammed uniformly and to a proper density to form a lining that will not cut, wash or scab while the iron is flowing into the mold.

Special Devices Used

The foregoing brief review includes the principal main features. Details of the various steps in the process of making cast iron pipe by the centrifugal method in sand lined iron molds present many points of interest, not the least of which is that mechanical equipment has taken the place of men to a greater extent than in any other branch of the foundry industry. Even where men are employed, practically nothing is left to their individual discretion or judgment. A workman pushes a lever or a button and the mold is made, poured and shaken out. The shop, properly speaking, is a factory and appropriately enough it is under the direction of an engineer, a long time employe of the company, who had a great deal to do with the design and installation of the equipment.

Sand from the hopper under the shakeout grating is lifted by a bucket elevator and discharged in a pile on the floor. It is spread in a long pile by hand and wet down with claywash and then cut over five times by a revolving sand cutter which finally throws it into a pile close to a second bucket elevator which lifts this aerated and cooled sand to a lofty steel bin. A belt conveyor takes the sand from this storage bin and distributes it to a series of four hoppers located above the four ramming machines. Each machine rams two pipes at a time. Therefore, each sand hopper is provided with two spouts to feed sand into the molds.

Two of the heavy, cast-iron molds for 8-inch pipe are shown in ramming position in Fig. 7. Each of these molds is equipped with a collar at the

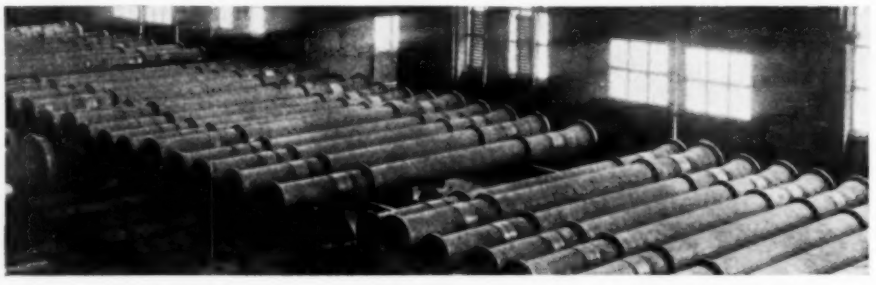


Fig. 11—Molds With Castings Inside Remain Approximately One Hour on the Skidway Before They Arrive at the Shakeout Station

end for attaching the end plate. Two slightly raised surfaces about 9 inches wide and located 3 feet from each end are machined accurately to revolve in special bearings during the casting period. Small vent holes are spaced approximately 6 inches apart over the entire mold. To follow the description closely it is necessary to bear in mind that the molds are in a vertical position during the ramming period and later while they are being shaken out. During all the other stages of their progress they are in a horizontal position. Accurate and ingenious rigging has been developed to shift the molds from the horizontal to the vertical and back again to the horizontal without jarring the sand lining loose.

Part of the equipment is shown in Fig. 5. The two empty molds are laid horizontally on a truck hinged at one end and mounted on a steel frame over a pit. Shoulders on the molds rest against the end plate of the truck. One end of a piston rod is attached to the lower side of the truck as shown and the other end is actuated by a hydraulic cylinder mounted on trunnions. In practice, the molds are placed horizontally on the truck. Water is admitted to the cylinder and the truck with its load of two iron molds is pushed to a vertical position, where the lower ends of the molds rest on the ramming table of the jolt machine.

Ram the Molds

Metal patterns shown in Fig. 7 and suspended from the roof beams, are lowered into place. A suitable taper at the bottom guides them into the sockets of the pattern plate. The operator standing on the platform puts on the top hopper and simultaneously starts the jolting machine and the stream of sand from the hopper. When the mold has been rammed to the top, the operator stops both and forms the spigot end on the pipe by forcing a loose metal ring down into the sand. The long patterns attached to stout steel cables then are withdrawn. The bead ring which really only forms a print for a ring core, then is removed and the molds are blacked on the inside by the simple expedient of throwing a bucket of blacking on to a disk with a long handle and lowering the disk to the bottom of the mold. The disk is a close fit.

The truck with the molds then is pulled back to a horizontal position. The upper truck wheels engage the bent guides *A*, Fig. 5, which may be noted on the upper side of the steel frame and thus ease the molds into place gently. The molds then are placed on a long skidway as shown in Fig. 6 where the flame from an oil burning torch is introduced for a few minutes at each end. That is all the drying the sand and blacking receives before the iron is poured into the green mold.

Without an actual demonstration, the average foundryman would not believe that molten metal would lie quietly against such a damp surface. The explanation, of course, lies in the fact that the sand is extremely open, the mold is plentifully provided with vent holes and the centrifugal force added to the natural weight of the iron prevents any passage of steam inward. All the steam is driven out and it is done so quickly that it is condensed to the extent of approximately a gallon for each mold on the cold walls of the hood under which the mold revolves.

As the molds are rammed they are placed in succession on the skin drying skidway and then are lifted in turn from the end of this skidway as shown to the extreme right in Fig. 2 and placed in one of the pouring machines. At present eight of these devices are in operation on various size pipe. Extensive experiments have been conducted to determine the proper revolving speed for each size pipe and a suitable motor with automatic accelerating control and cut off has been mounted at the end of each machine as shown in Fig. 1. Under ordinary conditions, a definite size pipe is made regularly on each machine, but if necessary, the machine may be adjusted to handle other sizes.

The hood of the machine is supported on two hydraulically operated plungers at each end and may be raised to permit the entrance of the green mold and the removal of the mold after the pipe is poured. The bottom part of the machine, also the hoods, are provided with rollers that serve as bearings or steady rests for the revolving mold. A pouring basin is mounted at the opposite end from the driving motor and is designed to hold just the proper amount of iron to make a pipe.

In the beginning, the pouring end of the mold is raised about 2 feet higher than the opposite end. An upright rod is attached to the pouring basin and as the mold and basin descends this rod forces the basin to tip gradually. By the time the mold has assumed a horizontal position the basin is empty and the mold is spinning at full speed.

Approximately two minutes elapse from the time the mold starts spinning until it comes to rest. The hood is raised, the mold containing the red hot pipe is removed and replaced by another mold from the preheating station. The special, automatic, toggle-jointed, double flask hook shown in Fig. 3 has been developed to handle two molds at a time. Molds containing castings are placed on a long skidway shown in Fig. 9 and generally occupy about an hour in moving from one end to the other end. From the far, in this instance the right end of the skidway, the molds are picked off two at a time placed on one of the two shakeout machines.

(*Concluded on Page* 156)

Fig. 12—Molds Are Placed Vertically on a Jolt Machine Where All Sand Is Shaken Out

A. F. A. Looks To Philadelphia

PLANS for the 1928 convention and exhibition of the American Foundrymen's association, to be held in Philadelphia, May 14 to 18, rapidly are taking form. A number of committees, composed of leaders in the foundry industry in Philadelphia and headed by Guilliam H. Clamer, president of the Ajax Metal Co., are engaged in arranging for the entertainment of the convention visitors. Tentative entertainment plans will be announced in a short time.

Early indications point to a record breaking exhibition in Philadelphia. Floor plans for the exhibition, which will be held in the Commercial museum, have been sent to manufacturers of foundry equipment and supplies and C. E. Hoyt, the association manager now is proceeding with the assignment of space. Since manufacturers of equipment have spent considerable time and money during the 18 months since the previous exhibition in perfecting and refining their products and developing new ideas, undoubtedly more new equipment will be featured at the Philadelphia show than at any time in the past.

A tentative schedule of technical sessions which will be held during the convention week has been prepared by the program committee of the American Foundrymen's association and announced by R. E. Kennedy, technical secretary. A number of valuable sessions will be held, at which various problems facing the industry will be discussed. Sessions will be devoted to nonferrous metallurgy, steel founding, cast-iron practice, foundry costs, steel metallurgy, foundry management, foundry coke specifications, apprentice training, malleable iron founding and sand control. The technical sessions scheduled for the mornings of the convention week will be held in the meeting rooms of the Bellevue-Stratford hotel. The afternoon meetings, which are of general interest, will be held in meeting rooms located in the Commercial museum, the scene of the exhibition. The tentative program of technical sessions is as follows:

Monday, May 14

Registration and committee meetings.
First session of cupola operation course.

Tuesday, May 15

Morning

Opening meeting and business session.
Nonferrous metals.
Steel founding.
Cast iron.

Afternoon

Foundry costs.
Second session cupola operation course.

Wednesday, May 16

Morning

Steel Metallurgy.
Cast iron.
Round table on brass founding. (Noon)

Afternoon

Foundry management.
Foundry coke specifications.
Third session cupola operation course.

Thursday, May 17

Morning

General foundry practice.
Apprentice training.
Round table on malleable founding. (Noon)

Afternoon

Sand control.
Fourth session cupola operation course.
Materials handling.
Malleable founding.

While the list of papers to be presented at the technical sessions is not complete, the group which has been announced indicates that much exceptionally fine material will be presented. Interests of all four branches of the industry have been considered and in addition the varied interests of the metallurgist, the executive, shop manager, engineer and the practical shop man have been given attention. A partial list of the papers to be presented follow:

"Furnace Refractories for Brass Foundries," by H. M. St. John, chief metallurgist, Detroit Lubricator Co., Detroit; "Science in the Foundry," by E. F. Hess, metallurgist, the Ohio Injector Co., Wadsworth, O.; "Risers, Their Need and Feed," by R. R. Clarke, alloy foundry, the General Electric Co., Erie, Pa.; "Variables in Steel Foundry Practice," by F. A. Melmoth, Thomas Firth & Sons, Ltd., Sheffield, England, annual exchange paper of the Institute of British Foundrymen; "Economies in Oxy-Acetylene Cutting for Riser Removing," by G. O. Carter, consulting engineer, Linde Air Products Co., New York; "Sand Reclamation in the Steel Foundry," by D. M. Scott, the Gould Coupler Co., Depew, N. Y.

"Interdependence of Operating and Sales Departments in the Success of a Foundry," by K. V. Wheeler, Lebanon Steel Foundry, Lebanon, Pa.; "Theory of Cupola Operation in Relation to Practice," by R. B. Schaal, Roberts & Manders Stove Co., Hat-

boro, Pa.; "Automatic Blast Gate Control for the Cupola," by H. W. Crawford, industrial department, the General Electric Co., Schenectady, N. Y.; "Necessity for Creating a Casting Consciousness," by A. F. Jensen, Hanna Engineering Co., Chicago; "The Schedule Fallacy," by J. J. Ewens, the George H. Smith Steel Casting Co., Milwaukee; "General Characteristics of Alloy Steel Castings," by J. W. Frank, Chicago Steel Foundry Co., Chicago; "Manganese Steel," by H. P. Evans, Pettibone-Mulliken Co., Chicago; "The Research Laboratory of the American Steel Foundries," by W. C. Hamilton, research director, American Steel Foundries, Indiana Harbor, Ind.; "Temperature Measurements of Molten Cast Iron," by H. T. Wensel and W. F. Roesser, bureau of standards, Washington; "Influences of Carbon Silicon Variations in Cast Iron," by D. G. Anderson and G. R. Bessmer, foundry engineers, Western Electric Co., Chicago. "Producing High Strength Cast Iron," by John D. Miller, general superintendent, Cresson-Morris Co., Philadelphia.

"Basic Principles of Management in the Foundry," by J. D. Towne, consulting engineer, Dayton, O.; "Stabilizing Labor and Cutting Cost by Horse Sense," by A. D. Lynch, director of personnel, Ohio Brass Co., Mansfield, O.; "What Does the Buyer Expect for His Money," by J. A. Marks, Purchasing manager, Packard Motor Car Co., Detroit; "A Contribution to the Training of Labor and the Personnel of the Foundry," by A. Soupart, director of Musee, Professional de l'Etat et des Ecoles Techniques de Morlanwetz, exchange paper of the Association Technique de Fonderie of Belgium; "Heat Losses From a 75-Ton Hot Metal Car," by W. F. Roeser, bureau of standards, Washington; "Surface Conditions of Castings as Affected by Core Sand Mixtures," by H. L. Campbell, University of Michigan, Ann Arbor, Mich.; "Testing Molding Sands for Durability," by M. A. Blakey, International Harvester Co., Milwaukee.

"Sand Conservation and Control in the Gray Iron Jobbing Shop," by T. F. Kiley, Brown & Sharpe Mfg. Co., Providence, R. I.; "Sand Control in a Light Casting Foundry," by W. G. Reichert, metallurgist, Singer Mfg. Co., Elizabethport, N. J.; "Materials Handling and Its Relationship to Building Plans," by E. F. Scott, engineer, the Austin Co., Cleveland; "Reducing Scrap in the Malleable Foundry," by R. A. Greene, assistant manufacturing superintendent, Ohio Brass Co., Mansfield, O.

This list of papers will be supplemented by others and by reports of various committees of the American Foundrymen's association.

The four period discussion course on cupola operation is an innovation this year which should be of interest to that large group of practical men in cast iron foundries operating cupolas. These discussion groups will be held on each of the first four days of the convention. The schedule for this course is as follows:

Monday, May 14

First period, Dr. Moldenke, leader.
Principles underlying cupola melting processes.

Tuesday, May 15

Second period, E. J. Lowry, leader.
Cupola construction details.
Suggested items: Tuyere systems; windbox arrangement; cupola heights for best economy; cupola spouts both ordinary and slagging; forehearths; mixing ladles; slag offtake systems.

Wednesday, May 16

Third period, David McLain, leader.
Cupola charging practice.
Suggested items: Sequence of charges; size of charges; coke ratios; hand and machine charging; warming up the charged cupola; interruption while running; continuous melting; fans, blowers, etc.

Thursday, May 17

Fourth period, H. W. Dietert, leader.
Cupola improvements.
Suggested items: Temperature regulation and measurement; new and proposed types of cupolas; extreme superheating of metal; special charges for high-test cast iron; the use of all steel; petroleum coke, etc.

A special room in the exhibit hall will be set aside for the technical exhibits, including the molding sand testing and control exhibit of the joint committee on molding sand research, the Obermayer foundry device contest, the exhibit of castings and patterns entered in the apprentice molding and pattern making contests and the exhibit of malleable, steel and cast iron castings. The latter exhibit is for the purpose of showing the engineering possibilities of the three classes of ferrous castings.

The casting exhibit for the malleable industry will be arranged under the supervision of the Malleable Iron Research institute, that for steel castings will be under the direction of the Steel Founder's Society of America and the display for the cast iron industry will be under the supervision of a committee representing various phases of the industry.

The apprenticeship contest display will be composed of patterns and castings which have been judged the best in the apprentice contests held under the direction of various district foundry associations and individual plants. The judges of the national contest at the convention will choose the three best entries in each group, namely cast-iron molding, steel molding and pattern making. The winners will receive the prizes given by the American Foundrymen's association.

The 1928 Obermayer prize will be awarded to the person submitting a device, drawing or model of some jig or method, which, in the opinion of the judges, embodies the best ideas for economical production of castings. The entries may be in the form of models, the device itself, or drawings and photographs together with a written description stating the purpose, application and advantages of the device. The award, in the form of a prize, is provided by the interest on a fund donated to the American Foundrymen's association by the S. Obermayer Co., Chicago. The contest is open to any shop man connected with a foundry or patternshop. Devices which have won the prize in the past are as follows: Rochester, 1922—A fixture for making green sand cores of two fittings in a single box; Cleveland, 1923—A device used in making 12-inch chilled mine car wheels; Milwaukee, 1924—A roller gagger and core rod mold former; Syracuse, 1925—A continuous iron temperature recording device for recording temperatures of iron at the cupola spout; Detroit, 1926—A safety device for raising cupola drop bottom doors. Those wishing to enter this contest should notify the secretary of the American Foundrymen's association, 140 South Dearborn street, Chicago.

Wants Definition for Special Annealing

Attention of steel foundrymen is called to A.S.T.M. tentative standard A-119-27 T "Tentative Definitions of Terms Relating to Heat Treatment Operations." Under this heading the term *Annealing* is defined as "a heating and cooling operation of a material in the solid state." This definition necessarily is broad to cover all types of annealing practice now in use.

It has been suggested that a specific term be proposed for steel foundry slow-cool annealing practice in which castings are heated above the critical, followed by furnace cooling. Those interested in this question are invited to send their comments and criticisms to A. W. Lorenz, chairman, American Foundrymen's association committee on heat-treating of ferrous castings, the Bucyrus-Erie Co., South Milwaukee, Wis.

William W. Dodge has been appointed sales representative in western New York state for the C. O. Bartlett & Snow Co., Cleveland, with headquarters at Warsaw, N. Y. Mr. Dodge recently was associated with the Dodge Mfg. Co., Mishawaka, Ind., in various capacities, including vice president and general manager of the Chicago district.

Cleaning Room Progress Aids Production of Quality Castings

By Frank G. Steine[illegible]

Part I

ARCHAEOLOGISTS have gathered sufficient evidence in Egypt, Asia Minor, China and other portions of the world to prove that civilized man produced objects of iron and other metals several thousand years before the dawn of the Christian Era. The first objects probably were made by heating a small portion of metal until it became a plastic mass and then pounding it into the desired shape with stone hammers. As man learned more about the metal, he found that he could make other objects, which were much more difficult to reproduce, by heating the metal until it reached the molten state and then pouring it into an impression made in an object which would not be affected seriously by the heat of the metal.

Objects found in numerous excavations indicate that castings first were made in molds carved in stones. However, as the wants of man increased, he probably found it desirable to increase the number of articles made of iron. Perhaps, in looking about for material for making molds which would require less effort to prepare than the molds carved in stone, he may have tried pouring the metal into a mold made in a lump of clay or hollowed out from a convenient bank of sand. Without a doubt, his efforts were crowned with success, for he found that he could produce a satisfactory casting in the new mold. However, in solving one problem he created another which has bothered foundrymen from that prehistoric time down through the ages to the twentieth century.

After the metal had solidified and the casting was pulled from the earthen mold, it was found that a certain amount of the sand had adhered to the metal and that a thin crust surrounded the casting. To finish the object, and prepare it for use, it was necessary for the ancient founder of bronze or iron to clean this sand from the face of the casting. It is not hard to imagine the cleaning methods which were followed. Probably the worker gathered a bundle of sticks and tied them together at one end, thus forming a brush. With this crude implement he could beat and brush a portion of the sand from the casting. It is thought by some authorities that the surface of the casting was rubbed with pieces of stone where it was necessary to obtain a finer finish than that secured with the crude brush.

Castings continued to be made of nonferrous metals, since it appears that the art of casting iron was lost about the first century and did not appear until approximately the thirteenth century. Throughout the centuries that intervened, man's greatest use for metals was in the manufacture of implements of warfare. When iron founding again became known, leaders of warring nations found castings of great assistance in defeating the enemy. Iron founding first was practiced in England in 1500 and a few years later the first iron cannons were made. These castings were cleaned by brushing, as was the case thousands of years before, although it is probable that a more refined type of brush was used to clean the cannons.

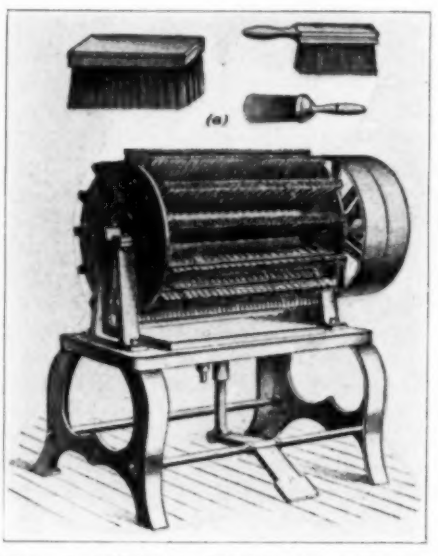


FIG. 1—SEVERAL TYPES OF BRUSHES USED IN THE CLEANING DEPARTMENT 30 YEARS AGO

Although founders of iron and other metals continued for many years to use hand methods in cleaning castings, it is interesting to note that the first step toward production methods in foundry practice was made in England several centuries after the introduction of the art of casting iron in that country. In 1708, Abraham Darby, who later won fame as the first person to smelt iron in the blast furnace with coke as the fuel, patented the process of casting metals in sand rammed into flasks. Darby and John Thomas made an iron kettle using that practice which is the foundation of the modern iron foundry industry. However, for more than one hundred years, the process of sand casting in flasks was carried on in secret with plugged keyholes and barred doors.

Brushes probably were used to clean the first casting known to have been made in America, namely an iron pot cast at the Saugus Iron Works, Lynn, Mass., in 1644. For many years castings poured in America were cast at the blast furnace and consisted chiefly of pots, firebacks, cannon and ship castings, such as bells and

anchors. Later the cupola came into wider use and foundries were established which secured metal by melting pig iron and scrap metal in the cupola.

In the year 1742, Benjamin Franklin invented the open front stove for heating houses, and shortly after that stove castings began to appear. Many of these castings were highly ornamental, and in some cases were copied from fire backs made in Germany and other European countries. However, during that period practically all manufacturing was carried on in the home, each family producing sufficient food and clothing to meet its needs. Little machinery was used in producing the necessities of life and for that reason the demand for castings was extremely small.

However, as the manufacturing center gradually was moved from the home to the factory, and the market for commodities increased, demand for iron castings grew. Although the article itself may have been fashioned from some other material, for example cotton cloth, iron in some form usually was required in the various types of machines used. The invention of the steam engine opened a wider field for castings. Development of the textile industry along the North Atlantic seaboard increased the demand for iron.

Although in most instances the frames of early machines were wood, numerous castings were required for many of the smaller parts. As the textile industry grew and methods were adopted to secure greater production, castings replaced the wood parts, thus creating a condition which led to the establishment of numerous foundries and machine shops in that section of the country.

Although progress may be noted, the early iron industry in America was a small affair compared with the enormous size developed in later periods. While each industry has played a part in creating the demand for iron and steel, the railroads have been the greatest factor in placing the iron and steel industry in its present eminent position. However, heavy demands from railroads were not felt to any great extent until 15 to 20 years after the first train made a successful run. Real development of the railroads of the United States did not begin until about the close of the Civil war. In 1860 only 52,000 miles of track had been laid, while 30 years later 163,597 miles of track were being operated.

Not only did the railroads consume enormous tonnages of iron and steel, but as the tracks were pushed west through the fertile Mississippi valley, the railroads opened a market for wheat, corn, oats and rye raised in that rich agricultural country. With the world markets at their doors, farmers increased the amount of land under cultivation and new settlers cleared more land. This in turn created a need for farming implements of various kinds and increased the demand for castings. Even now the story is only partly told. With increased buying power, the necessities and the luxuries purchased by the western farmers also increased the demand for castings, both directly and indirectly.

As the foundry industry developed rapidly, due to the demands from industry, the railroads, the farmers, etc., foundrymen found it necessary to amplify the hand methods employed satisfactorily when iron founding first was introduced in America. It became necessary for the owner of the foundry to employ methods which would permit him to make castings on a production basis. Foundry equipment not only became desirable but a necessity as well. Mechanically inclined foundrymen devised numerous rigs and methods which were forerunners of much of the equipment now used in the modern foundry. During the period of transition, which probably began about the middle of the nineteenth century, changes of a radical nature began to appear in methods used to clean castings, notably in brushes and brush equipment.

Of course, many improvements had been made in the types of brushes used. Wire scratch brushes were used to remove the sand and scale from the castings. These brushes usually were made of from No. 16 to No. 28 wire gathered in a mass and held tightly in some form of handle. Revolving brushes, either power or hand driven, had been introduced and were being used in many shops. One type of revolving brush used in the latter part of the century is shown in Fig. 1.

About the same time new methods of cleaning began to appear. It is difficult to determine which of the several methods used in the latter half of the century appeared first. Practically all of the foundry writers of the period were molders, and consequently their writings covered the subject with which they were most familiar. However, it is probable that tumbling, grinding, pickling and sandblasting were developed at about the same time, although tumbling and pickling were used more extensively at first.

This is the first of a series of articles dealing with the various types of equipment used in the cleaning room. The second will appear in an early issue.

Appoints Representatives

Three representatives of the American Foundrymen's association have been appointed on the ferrous metal advisory committee to the bureau of standards for 1928. John Howe Hall, metallurgical engineer, Taylor-Wharton Iron & Steel Co., Highbridge, N. J., is chairman of the American Foundrymens association group and represents the steel casting section. H. Bornstein, chief chemist, Deere & Co., Moline, Ill., represents the cast iron section and J. B. Deisher, consulting engineer, 24 Roslyn street, Rochester, N. Y., represents the malleable section.

The advisory committee to the bureau of standards meets once a year with the staff of the bureau. This committee goes over the activities of the bureau advising as to the projects which seem to be of greatest need to industry. It also discusses projects which should be given future consideration. The next meeting of the committee will be held in Washington, May 11 and 12.

Buys Bronze Foundry

P. J. Flaherty, president and general manager, has purchased the Johnson interests of the Johnson Bronze Co., New Castle, Pa. No change is contemplated, either in operation or personnel, Mr. Flaherty continuing as president and general manager. The company was organized originally in 1901 as the American Car & Ship Hardware Co. From 1901 until 1909 the company devoted its entire production facilities to the manufacture of miscellaneous hardware for steam and electric cars. Since that time, it has concentrated on the manufacture of a widespread line of finished bronze bushings, babbitt-lined bearings, and sheet metal bearings as well as specializing in bronze castings for steam and electric railroads. The main plant at New Castle covers 2½ acres and gives employment to over 500 people. Warehouses are located at New Castle, Chicago, Kansas City, and San Francisco.

Gives Beryllium Data

The bureau of standards recently has published a bulletin entitled, "Thermal Expansion of Beryllium and Aluminum-Beryllium Alloys", by Peter Hidnert and W. T. Sweeney. The bulletin which is Scientific Paper No. 565, bureau of standards, gives results on the linear thermal expansion of 98.9 per cent beryllium and five aluminum beryllium alloys containing from 4 to 33 per cent beryllium. The price of the bulletin is 10 cents.

Initiative Benefits Civilization

By S. Wells Utley

An Interesting Article Abstracted from a Paper Presented Before the Pittsburgh Association

WHEN I came out of the university some twenty-five years ago, I faced that question which comes to every young man as to what I was to do. My inclinations and the advice of my friends pointed to becoming a lawyer. My pocketbook suggested strongly that I get a job, and as often is the case, under such conditions, the pocketbook won. However, one of the factors, in making the decision, and one which removed from it any feeling of regret, was the fact that during my university life I had had occasion to devote some little time to the study of the effect of industrial life upon civilization. It had seemed to me that this life possessed a romance which was little understood.

However, as years went by, I began to notice a tendency, on the part of those who class themselves as being more intellectual than the rest of us, to look down on the man of industry, to accuse him of being interested only in the making of money, to infer that somehow the lawyer, the doctor, the scientist, the man of letters was of more real use to the human race than he. I began to wonder what place we really occupied in the progress of the human race, and what, after all, were the principles underlying our industrial civilization.

Develop Scientific Lines

If I were to ask you in what way our civilization shows progress as compared to that of ancient times, I suspect almost unanimously you would reply "in every way." An examination of the situation would indicate that such is not the case. Dr. Hugo Munsterberg, the celebrated psychologist of Harvard university, who can scarcely be accused of being prejudiced in favor of industry, declares that only in the development of though along scientific lines and in the organization of industry itself, do we show any advancement over ancient times. No buildings, says he, have been built in the twentieth century as beautiful as those of the old Greeks; no dramas have been written as wonderful as those of their great poets; no philosophy has been taught so significant as that of their great thinkers. The chiseled statues of their sculptors are both the admiration and despair of those who today would rival them.

Our legal life and jurisprudence is not superior to that of the old Romans, and our state and city politics, together with our politicians are not essentially different from those of ancient times. We are stirred by the same motives, buoyed up by the same hopes, depressed by the same fears, spurred on by the same love of family and friends, torn by the same hatred and jealousies. Man is the same before his God. He is the same in his family. He is responding to the same forces and emotions today as have his ancestors for countless generations before him.

If there has been no advancement in the things of the mind, and we still feel that progress has been made, then it must be along other lines and in other fields.

Measuring Progress

I take it that the measure of the progress of civilization is the decrease in the gap that existed between the living conditions of King Tut and the slaves who labored in his tomb, and between Henry Ford or John D. Rockefeller, for instance, and the men who labor in their plants. As Dr. Eaton has beautifully expressed it, "Progress is the growing share of more and more people in more and more of the good things of life."

Economists tell us that when the Declaration of Independence was signed some 151 years ago, the total estimated wealth of the entire world was $100,000,000, They tell us further that the income of the people of the United States in the year 1926 was somewhere between $60,000,000,000 and $90,000,000,000, depending largely upon the methods used to estimate it. The income of this little handful of people, only about 4 or 5 per cent of the population of the world, located in a relatively small portion of that world's surface, in a single year amounted to 75 per cent of the entire capital assets accumulated by the human race in 100,000 years. Words of the English language cannot be framed to express a more startling statement. It is indeed hard to conceive of any statement of facts which can so challenge our understanding or call for more careful inquiry as to the principles underlying it.

Builds Intricate Machine

With all of our ingenuity, with all of our scientific development, man never has been able to approach in efficiency or in beauty some of the accomplishments of nature. In great universities and in some of the wonderful industrial plants, are chemical laboratories which approach the last word in their completeness. This country has research men who are nowhere excelled. However, all of these put together do not begin to produce as wonderful chemical results as does the laboratory which each one carries under his own skin. Some of the great shops produce wonderful machines, but the best engineers have not even dreamed of a machine so perfect that by simply feeding fuel to it, it will function for 50 or 100 years, taking care of its own maintenance, repairing its own deficiencies, constantly expanding with its increasing demands. Yet such a machine is the human body. Medical science has done much to prolong its life, largely by destroying the enemies of its health, but no one yet has proposed that the surgeon remove the vital organs nature has provided and replace them with some man-made device.

But wonderful as is this bodily machine, it is no more awe-inspiring than is the economic machine which nature or society has set up to take care of it; a machine which has brought about a condition so that in

this country of ours, at least, the man who works on the lowest round of our industrial ladder has more of the comforts of life, more of the luxuries even, than did the richest man in the world in the days when my grandfather was a boy.

Tomorrow morning I suspect 90 per cent of the adult population of this broad land of ours will sit down to a cup of coffee, made from berries grown on the other side of the world, by a race of different color and a nation foreign to us. So perfect is our economic system that this coffee came to us over thousands of miles of water and hundreds of miles of land without a single thought on our part, and at an expense equivalent to less than a few minutes of the time of the poorest paid man.

We should be able to see that everything we have today, our food, our clothes, our homes, our education, are the results primarily not of our own efforts but of the common effort of our entire generation, together with the accumulative efforts of all those who have labored before us in the building-up of what we call civilization. If this is true, why have all these men worked for us? Why are you and I working, for generations yet unborn?

Society has so organized herself that profit, and I do not mean money alone, but the other rewards which come from effort, can be made only by producing something which society wants, on terms which she is willing to accept. The basis of our progress is the fact that society holds out a direct and definite reward for accomplishment, and thus stimulates the use of brains and initiative. It is as though she said to man, think, work, produce, and I will allow you a share of what you do for me, which you can continue to hold for yourself and yours only as you continue to produce for me. The significant thing in our industrial structure is not that men of conspicuous ability in any line become wealthy, but rather that in accomplishing the things for which riches are the reward they contribute immensely to the advancement of all.

The second great principle is that the possibility of advancing one's own interest, and that of the loved ones dependent upon him, is the greatest known spur to the human mind. Since time immemorial this willingness to work harder, to sacrifice more to advance his own interests than for any other cause, has been the mainspring that has actuated human progress. Society's granting to the individual the reward for his accomplishment is the incentive which has spurred him to expend the best that there was in him for society's service. It has made our present civilization, and that civilization will continue to progress only so long as the principle continues in operation.

And the third great principle is that notwithstanding the size of our plants, the complexity of our organization, the mass of our machines, the apparent materialism of our existence, the world is still a spiritual world, for the mind of man after all controls all this great mass of things, upon which, to a large extent, our welfare depends. There is nothing in the world more useless than a great plant from which the power has been cut. But charge the wires with the mysterious current which we cannot see or hear or even define, and the useless machinery vibrates with life and power. It is the same way with our social and economic machinery, for unless it be vitalized by the energy of the human brain, civilization fails. Our industries cannot survive unless they be vitalized by an intangible something we cannot describe; a brain which unites an ability to analyze, a power to think, a will to produce action; a subtle something which forces the human machine to function and at the same time shows it how to function.

Depends on a Few

Sometime ago Mr. Babson stated that if the top 2 per cent of the citizens of any large city were removed suddenly, the remaining 98 per cent would not have sufficient initiative to keep from starving to death. I have in mind a large motor company in my own city which four or five years ago was as near bankruptcy as it is possible to be. A new president was put in charge. Immediately it commenced to forge ahead, until today it stands among the leaders in popular esteem and financial position. The change was brought about purely by the ability of a single man. I don't know why it is decreed that less than 1 per cent of the people should be able to paint our great pictures, or chisel our great statues, or write our great music, or why it is decreed that only about 2 per cent should have the vision and the ability to shape our industrial life. However, just as the pleasure the great artist gets from painting his picture is small compared to the joy the multitude gets from reveling in its beauty, so the return gained by the industrial leader is insignificant compared to the benefit derived by society from the accomplishment which gave him his wealth. By and large, society rewards the individual in proportion to the contribution made to her. A man may bring forth a single thought for which the world has been waiting for centuries, and his reward will seem staggering, or on the contrary, even though possessed of the finest training, he may produce nothing but the work of his two hands, for which he will get a bare living. More likely he may fill a place between the two, doing daily the tasks which come to his hand to the best of his ability, meeting his fellowmen with a spirit of pleasure in their joys, and of helping their sorrow, steadfast, honest and just, loving his home and his family.

Of such men is industry made. Industry is built on honesty and character. To such men does society give her richest reward. Rarely does a rich man take either pride or pleasure in money. A man who has achieved large rewards glories in the struggle won, in the obstacles overcome, but like his brother of little means, he is happy and contented only if he has the well-earned love and esteem of his fellowmen.

These rambling remarks will not help any-one make castings in the foundry, but perhaps they will help all to realize the position of the foundry industry in the general scheme of things. I cannot believe that the men who have crystallized their dreams of human flight into the aeroplane which soars above our heads are any less artists than the ancient sculptors who chiseled a winged foot to represent that flight. I cannot believe that the men who have enabled us to throw our voices around the world have contributed less to the progress of the human race than those who as artists or poets have dreamed of the day when this might be. Industry is not a thing of stone and steel, massive and material, gross and thinking only of profit. It is a thing of living, throbbing men, working that humanity may have the greatest volume of blessings with the fewest drops of human sweat. As you and I work in the sand of the foundry, adding to the wealth of the world by creating those things which never existed before, we can take to ourselves the consolation that we have a definite place in the scheme of things not excelled by anyone else. Amid the trials and tribulations we can go forward calmly, serene in the certainty that for generations still unborn the world will be a better and happier place because we of the industry have lived and labored in it.

How and Why in Brass Founding

By Charles Vickers

Add Less Phosphorus

We are sending you a sample broken from a bronze ring. The fractured surfaces reveals a structure which is not homogenous. In fact it looks as though liquidation had taken place and so produced the various colors shown. The analysis of the metal follows: Tin 4.87 per cent; lead 4.74 per cent; copper 82.90 per cent; iron 0.14 per cent; zinc 7.14 per cent; phosphorus 0.021 per cent; loss or undetermined 0.289 per cent.

The metal is a good, ordinary red brass that has been poisoned by phosphorus. The scrap may be used to advantage as a deoxidizer of other heats, but add no more than 15 per cent or 20 per cent. Carefully exclude all phosphorus in making new heats. There is nothing that can be done to renovate the old metal except to dilute it as suggested. It might be well to avoid a reducing flame when melting such alloys. Simply cut down the phosphorus almost to the vanishing point and the castings will be satisfactory in every respect.

Permit us to commend the forethought of having analysis of the metal made before asking questions. This gives the information on which expert advice can be based. Without the analysis it would have been necessary to do a lot of guessing.

Coating Brass Castings

We have been making brass candlesticks and book ends and the brass tarnishes badly. Is there a coating which may be used to prevent such tarnishing?

The polished brass requires lacquering with a special fluid sold for such purposes and which adheres strongly to the metal surfaces and is water proof. All brass ware has to be finished with lacquer or it soon becomes unsightly. This fluid can be purchased from manufacturers who specialize in such products. When buying lacquer mention the sort of work and the kind of metal so the manufacturer can supply the most suitable grade. Apply the lacquer with a flat brush of fine bristles securely anchored so they will not pull loose and stick to the work. Apply it uniformly. Any excess should be removed with another brush free of lacquer. After lacquering dry the coating in an oven heated to around 150 degrees Fahr. It is necessary to have the brass surfaces clean before applying lacquer, and if the results at first are not particularly satisfactory, the lacquer can be stripped from the articles by immersing in a strong solution of lye, and brushing with a stiff brush. The stripped castings then must be dried and re-polished, when another attempt at lacquering can be made.

Ammonia Attacks Copper

We will thank you to give us a mixture that can be used for valves and gages handling ammonia and ammonia solutions. We want to cast this alloy in our own brass foundry.

If monel metal can be cast it would no doubt be the best alloy to use in a brass foundry for ammonia valves, as nickel is not attacked to any great extent by that reagent. Copper is strongly attacked by ammonia, but tin withstands it well. Therefore, the less copper in the alloy the better, but if a bronze is wanted there is a limit to the amount of tin that can be used. Even a bell metal is too brittle. Lead is not any too good in its resistance to ammonia. A 1/5 normal solution of ammonia "scarcely attacks lead at all" it is stated by some investigators, but a 1/5 solution is not at all strong. A copper-lead alloy therefore, is not indicated for ammonia, but an alloy of copper 87 per cent; tin 10.50 per cent; lead 2.50 per cent; is about as good as can be done in bronze.

If an alloy of tin 82 per cent; antimony 10 per cent and copper 8 per cent is suitable for the valves mentioned it will hold the ammonia better than the bronze. Cast steel is another metal that has been used satisfactorily for ammonia valves for many years.

Formula for Check Valves

Will you please send us the formula for a metal called composition? It is used for check valves.

Composition is simply another name for red brass. A suitable formula for check valves is copper 85 per cent; tin 5 per cent; zinc 5 per cent; lead 5 per cent.

Flanged Sides on Tablet Are Porous

We are making tablets having flanged sides and experience trouble due to the flanges coming porous. The tablets are made face down and the flanges, which are about 2 inches high extend into the cope. We gate the casting, which is rectangular in shape, along one long side, and also put pop gates in the middle of the back, with runner risers along the short sides which carry the flanges. The mixture is copper 86 per cent; zinc 10 per cent; tin 3 per cent and lead 1 per cent. French sand is used. The molds are put into the oven and are thoroughly dried before pouring. Charcoal is used on the melting metal and the pots are skimmed clean before pouring the molds. The metal is poured hot.

From the description given it would appear porosity is caused by steam which either accumulates in the flange cavity of the cope, or is generated there from a little dampness. It frequently happens that although a mold may be oven dried it may not be bone dry throughout, in which case a slot opening like the flange part of the mold will be quite damp a short distance in from the face. The molders should have credit for thinking of needle venting all along these flange openings. That is done by threading a knitting needle through the sand of the cope at close intervals all along the slot.

If this has been done right along and has not remedied the porosity it is time to use a more open sand in molding the sides of the flange. Get a rather coarse ordinary molding sand and bank against the sides of the flanges, and over the top of the flanges when ramming the cope. This will facilitate escape of the gases which are driven into that part of the mold in pouring. This coarse sand can be trimmed away after the casting is made and the mold opened, so that it will not get mixed with the fine sand and ultimately spoil the pile. As the porosity seems to be confined to the flanges, it is not due to any fault in the metal. There is no need of a deoxidizer in the case of the alloy mentioned. Only phosphorus could be used and this probably would make the casting rough, unless only a small amount is used.

An Engineer Scans

Malleable Melting Practice

Furnace Design and Dimensions, Character of the Charge, Refractories, Analyses of Metal and Many Other Features Are Discussed in Connection with Use of Powdered Coal

By Aubrey J. Grindle

MYSTERY, tradition and rule of thumb methods, common to early American industries have almost disappeared. In 1890, malleable iron foundrymen began to employ scientific research to get accurate facts about their products, but discoveries made in this way were jealously guarded trade secrets. Nearly every foundryman had pet theories and there were almost as many kinds of malleable iron as there were foundries making it.

Since 1913, drastic steps to improve the dependability of malleable iron have been taken. Tradition has been thrown overboard. At present practically all malleable foundries in the United States are producing a metal with an average of over 53,000 pounds tensile strength; an average elongation of better than 17 per cent and a yield point of more than 35,000 pounds per square inch.

Pulverized fuel has played an important part in the improvement which has taken place in the past few years. At present 67 malleable iron foundries in the United States, use pulverized fuel. Most of these use it for melting. About 40 per cent use it for annealing and some use it for baking the cores and drying ladles.

Wherever a superior metal of uniform chemical analysis is required, the reverberatory type of air furnace must be used. To assure maximum quality of metal and minimum cost of production, pulverized fuel is used. During the past eight years rapid progress has been made in the use of pulverized fuel in melting and annealing malleable iron. Three distinctive types of pulverized coal systems are now on the market.

Lists Three Systems

1—The circulating system, with central pulverizing plant, where the coal is circulated through pipes by volume air, past the burners or furnaces where the desired amount is tapped off for each burner. However, this system now is used only for annealing ovens in a few plants. Experience has shown that the accurate control necessary for melting malleable iron requires a system where the coal and air supply is more dependable. Most of the circulating systems originally installed on malleable iron melting furnaces have been changed over to a single pipe line to each furnace. Several circulating systems are still in satisfactory operation on annealing ovens and other furnaces consuming small amounts of fuel.

Conveys Information

THIS report was prepared originally for the information of certain foreign malleable foundrymen interested in American malleable foundry practice, particularly where pulverized coal is employed for fuel for melting and annealing. The author, Aubrey J. Grindle was a pioneer in the development of powdered fuel in the malleable foundry field and elsewhere. The report, though brief, touches all the salient features. It is a typical engineering report by one perfectly familiar with his subject.

2—The hopper system, with central pulverizing plant where the coal is supplied to storage hoppers at, or near the furnaces and fed by screw feeder into the combustion air. This system, up to the past year, was the most commonly used, not only for malleable iron foundries, but for other industries.

3—The unit system, where the coal is pulverized at or near the furnace and fired direct, without any storage, is becoming quite popular. Unit pulverizers have been perfected during the past two years to such an extent that it is possible to reduce the initial investment required and at the same time, give the same operating results as the more expensive systems. Many of these units have been applied to malleable iron melting furnaces. Smaller units are now being perfected for annealing ovens and other small furnaces.

A malleable iron melting furnace of the reverberatory type, should be so constructed that the bath of metal completely melted will be approximately three times as long as it is wide. The side walls of the furnace should be kept as low as possible. The top of the rear bridge should not be over 4 inches above the metal when it is completely melted and preferably not more than 2 inches above the metal line.

Bottom Should Slope

Bottom of the furnace from the rear bridge to the tap hole should slope toward the tap hole not less than ¼-inch per foot and from the front tap hole to the burner end wall of the furnace, the bottom should slope approximately ⅜-inch per foot.

Bungs should have a radius of approximately 9 feet, 10 inches to the bottom of the frame or 9 feet 5½ inches to the underside of the bung brick.

Top of the furnace should slope in almost a straight line from the burners to the rear bridge wall. It is impossible, in some cases to follow a perfectly straight line, because of the skim door arch, but this opening and arch should be made as low as possible, to reduce the space between the bungs and the top of the metal to a minimum.

To secure maximum furnace efficiency, it is necessary that the furnace be completely filled with the charge, allowing only a small space between the rear of the charge and the bridge wall and approximately 6 feet from burners to the top of the charge in the firing end of the fur-

nace. In some cases, the iron has been piled within a few inches of the burner nozzles, but unless the coal is very fine, this is not good practice.

Area of the stack should be not less than 2½ square feet per ton of iron melted per hour, nor less than 60 feet high. A stack on a pulverized fuel furnace requires volume in preference to height, and the temperature in the stack should be kept below 1300 degrees Fahr., if possible. If this is done, any kind of coal can be used without danger of obstructing the stack area with fused ash. Ash from almost any coal will not fuse at temperature under 2000 degrees Fahr. A large stack which permits the induction of a generous volume of cooling air never will have to be relined on account of burning. Fused ash never will have to be removed. Ash always will be in more or less of a powdered form and quite easily removed.

A good example of stack area required for certain sized heats, showing the time required for melting, melt per hour, etc. is shown in Table I. This table is based on melting of second heats, because a second heat is always melted in less time than a heat in a cold furnace. Desired area 3 to 3½ square feet per ton of iron melted per hour. Stack should have a minimum height of 60 feet.

Table I

Stack Area Requirements

Tons	Hours	Melt per hour	Minimum area	Minimum diameter
10	3	3.3	8¼ sq. ft.	39 inches
20	4½	4.4	11 sq. ft.	45 inches
30	6	5	12½ sq. ft.	48 inches

Table II

Analysis of Iron

Section	Silicon	Sulphur	Phosphorus	Manganese	Total carbon
¼" to ¼"	1.00	0.06	0 16	0.27	2.60
¼" to ½"	0.90	0.07	0.14	0.31	2.40
½" to ¾"	0.75	0.08	0.12	0.31	2.30

Use of Refractories

Consumption of refractories in malleable iron plants presents such a difficult problem that accurate comparisons on different recommendations cannot be made.

In some plants melting furnaces are repaired at week ends and all brick work that will not run another full week is replaced. Others running one small heat per day, having extra furnaces or special repair programs, may be able to keep their melting furnaces in operation during the full life of the walls.

Practice in some plants is to spray the walls daily with high temperature cement or to make minor repairs between heats. This possibly increases the life of the refractories, but may not necessarily decrease the cost of maintenance. These and other factors, care in laying up the walls; variation in flame velocities and variation in proportion of air to coal, make comparisons of results from various brands of refractories more or less misleading.

Physical Properties

Melting furnace refractories must be divided into two classifications, one for side walls, and the other for bungs or roof of the furnace. Each service requires fire brick of somewhat different physical properties.

Side wall brick should be dense and hard, to better withstand abrasion and cutting action from the slag and velocity of the gases; yet, sufficiently porous in structure to prevent spalling due to sudden changes in temperature. These properties should be determined by the results obtained in the particular furnace where the brick is used. A brick that is entirely satisfactory for one furnace may give very poor service in another. This is not always the fault of the brick and is a situation that is rapidly finding its solution through replacement of hand-firing practice by pulverized coal.

Fusion point and chemical composition are the determining factors of satisfactory refractories for melting furnaces. Foregoing remarks are subordinated to these requirements and have especial reference to the preparation and treatment of materials from which fire brick are made.

The standard large 9-inch (6¾ x 2½ x 9-inch) shape seems to be the main choice for side walls. Use of this brick results in fewer joints, less labor for laying up and less breakage in handling. The bats also make better gaggers when used in the bottom.

Keep Oxygen Tank Handy

Use of tap hole blocks is a matter of choice. A number of foundrymen prefer the clay breast, which can be replaced easily at any time. A great deal of trouble at times may be avoided by having an oxygen tank handy for opening frozen tap holes. The only equipment needed is the tank of oxygen, a pressure gauge, hose connection and short lengths of small rubber tubing. With this device a badly frozen tap hole can be opened in a few seconds and without danger of breaking the breast or tap hole block.

Special shapes should be avoided as far as possible. They involve higher costs and larger stocks.

Good grade of fire clay ground fine and of such composition as will not flux the brick, should be used for laying up walls.

All vertical joints should be staggered and brick laid in thin batter of clay, better known by furnacemen as *soup. Thick clay joints should be avoided.*

Uneven courses of brick necessary to form contour of furnace wall should be laid below furnace bottom level so that only straight courses of brick will be replaced in making repairs. This not only makes a more solid wall, but saves considerable time for the bricklayer.

Thickness of melting furnace wall is usually 13½ inches, 4½-inch course against side plates and 9 foot course inside.

Side wall plates or outside course of brick should taper *outward* to the perpendicular about 4 inches on either side wall, to prevent wall falling into the furnace when weakened by cutting action of the slag at metal line

A practice with considerable merit is to use a 13½ x 6¾ x 2½-inch brick for two courses on top of side wall. These brick securely tie the wall together between outer and inner courses and also form a good rest for bung ends.

Patching Mixture

Wherever it is convenient to patch the side walls before charging the furnace, the refractory costs in many cases can be reduced by employing a mixture of 1 part carborundum, 2½ parts brick dust and 1½ parts first grade fire clay.

If brick dust is not available, a good silica sand will serve the purpose. If the fire clay is not high in plasticity a larger amount may be required to produce a patching mud which will adhere to furnace walls. It is not desirable to put on too heavy a coating of this mixture,

because the weight is apt to make it sag. The best practice in applying this mixture is to splash the wall, preferably while warm, with a thin clay wash before troweling on the carborundum mixture.

A good bung brick is usually more porous than a side wall brick, to prevent spalling when subjected to sudden changes of temperature. Bung bricks are more exposed than side wall brick to severe changes in temperature. This is particularly true with the bungs removed for charging. The bung brick should be as dense and hard as possible under the foregoing limitations.

The 13-inch bung has become standard in most of the plants. Some of the advantages of the 13-inch over the 9-inch size are that the bungs are fewer in number; time is saved in repairs as well as charging; fewer bung frames are required; fewer joints to seal up after charging. Last but not least, a greater area of the brick is exposed to the air and not covered by the bung frame, which makes considerable difference in the life of the brick. Practically all bungs are 4½ inches in thickness. If the 6-inch thickness has not been abandoned entirely, it should be.

Table III

Suitable Coal

B.t.u.'s	13,500 or more
Volatile matter	30 per cent or more
Sulphur	1.00 per cent or less
Ash	8.00 per cent or less
Moisture	3.00 per cent or less

Bung Frames and Clamps

Steel I-beam bung frames are used in a great many plants. Where cast iron frames are used, it is desirable not to cover any more surface of the brick than necessary. The brick will last much longer if air cooled on one side. Variation in radius of bung frames is interesting. For furnaces of approximately the same width, the actual spring of the arch will show variations anywhere from 8 to 20 inches. Taper on the standard bung brick should not be expected to accommodate satisfactorily this variety of bung arches. Considerable trouble from spalling might be avoided by checking up the bung frames to see that the taper on the brick suits the radius of the frame. Among a great variety of clamping devices some actually crush the brick, while others do not exert sufficient pressure to support the arch.

Division of opinion exists as to whether the bung arch should be laid dry or with clay in the joints. The preference is to lay the brick dry and wash the joints with clay on the inside of the arch. This seals the cracks between the brick until the surface is fused, after which the joints are fused tight. Absence of clay between the joints provides more space for expansion of the brick and may lessen the tendency to spall. Actual tests have not shown that the bungs laid up with clay were any better than those laid dry. The brick next to the bung clamp always should be protected by a cast iron plate about an inch shorter than the length of the brick.

When using bung frames with a desired radius of 9 feet 10 inches, the arch bung brick known as No. 105, is superior to a combination of square and arch brick. The No. 105 arch bung brick is 13 inches long, 4½ inches high, 3 inches wide at the top and 2⅞ inches at the bottom.

Care of Refractories

Fire brick should not be exposed to outside weather conditions. They should be stored under cover and protected from water. Fire brick are fragile and should be handled with reasonable care. Where the brick is not actually broken through rough handling, the corners and sharp edges sometimes are chipped off and it is not possible to lay-up a smooth wall in the furnace.

Life of side wall will range from 10 to 22 heats, which gives little information of value for comparison, due to variations in size of heats, etc. Average life of bung brick will vary from 10 to 25 heats.

Solution to the refractory problem will be simplified by the rapid adoption of pulverized coal to malleable melting furnaces. With this advancement, the foundryman will be in better position to tell the brick manufacturers what he wants, which is a great deal more definite information than is now available. Until the hand-fired furnace is a thing of the past, more or less disagreement will prevail among foundrymen about the merits of various brands of fire brick.

In a few malleable foundries furnace bottoms are made up with a combination of fire brick and bottom sand. However, great difference of opinion between foundrymen, on whether the extra labor involved by the use of fire brick bottoms over all sand bottoms make it difficult to determine whether or not the brick bottom has any advantages over sand bottoms.

Various kinds of sand are used for bottoms: silica or sugar sand; lake sand; beach sand; steel foundry sand. The sand should contain a high percentage of silica and be free of vegetable matter. The bottoms should be put in with reasonably dry sand and should be well tamped and care taken to prevent an uneven surface. The bottom should be well leveled and sloped toward the tap holes.

Rear Bridge Wall

Many foundrymen prefer to cover the rear bridge wall with between 1 and 2 inches of first grade silica sand. This sand fuses and melts at a higher temperature than fire brick and therefore, does not cut away as fire brick does when laid on top of the bridge. It maintains a more satisfactory opening at the rear of the furnace.

By the use of pulverized coal as fuel, it is possible to use much more scrap in the mixture than can be used with any other type of fuel. Wherever malleable iron or steel scrap is available at a lower price than pig iron, large savings can be made by the use of scrap instead of pig.

Table IV

Operating Schedule

Time	Air Points	Coal Points
Start	7	6
30 minutes	9	8
60 minutes	11	9
Until hot	11	9
To hold	5	6

Various malleable plants require iron of varying analyses. Plants manufacturing very light castings with metal sections under ⅛-inch must produce a metal higher in silicon and carbon than foundries manufacturing automobile castings or railroad castings where the sections are as high as ¾-inch or even more.

Analysis of Iron

Table II gives the approximate analysis suitable for light, medium and heavy castings. Some malleable foundrymen prefer to produce a metal with lower carbon and higher silicon content, claiming a stronger and easier machined casting. However, there is a great difference of opinion on this subject. A good rule to follow regarding proportion of silicon and carbon is:

Light weight castings, silicon and carbon should total 3.60.

Medium weight castings, elements should total 3.30.

Heavy castings, a total of 3.05

will be found entirely sufficient.

Most foundries having a variety of castings, both light and heavy weight, use a mixture approximately as shown under the medium classification.

Many foundries have a rule covering the proportion of manganese to sulphur and this seems to work out quite satisfactorily in the majority of cases. This rule is to double the figure for the sulphur content of the metal produced from the furnace and add 0.15. For example, if the sulphur resulting from the furnace is 0.07, this doubled is 0.14, plus 0.15, gives 0.29, which is the desired manganese to balance the sulphur.

Phosphorus Unchanged

No noticeable change takes place in the phosphorus content of the metal from the time it is charged until it is poured. Therefore phosphorus should be figured in the mixture at exactly the amount required in the iron after it is poured. In producing the best grade of malleable iron, it is desirable to have practically no graphitic carbon noticeable in a hard iron test bar with a cross section about double that of the heaviest castings.

To get the best results in the use of the unit system in applying pulverized coal to melting furnaces, it is necessary to use a good grade of bituminous coal, containing not more than 1 per cent sulphur. The coal should be of uniform size to pass through a 1¼-inch screen. Large pieces of coal will obstruct the passage to the feeder and interfere with the operation of the equipment.

Analysis of coal, suitable for melting is shown in Table III.

Coal containing less B.t.u.'s than 13,500 has been used for melting iron, but there is no economy in doing so.

Coal containing as low as 0.20 per cent volatile matter has been used in melting iron in emergencies, but it is very hard to light up and gives an extremely short flame and does not heat the rear of the furnace as satisfactorily as coal of higher volatile content, giving a longer flame.

It is not desirable to use coal with over 1 per cent sulphur with the unit system of firing, unless high sulphur in the castings is not objectionable. If the sulphur in the coal increases over 1 per cent, it is necessary to pulverize the coal finer, to prevent increase in the sulphur content of the iron. Also it is better to leave more combustion space at the front of the furnace when high sulphur coal is used, especially when it is not very finely ground.

Moisture of coal used for melting should not exceed 3 per cent, although boilers have been fired with the unit system, with coal containing as high as 15 per cent. If the moisture increases over 3 per cent, trouble is encountered in plugging the bottom of the storage hopper and the feeder. As the moisture in the coal increases, the fineness of the coal produced by the unit pulverizer decreases, resulting in coarsely pulverized, wet coal, which results in late combustion in the furnace and coal dropping on the bath before it is consumed. This increases the carbon and sulphur in the iron and makes these elements very hard to control.

When using pulverized fuel equipment properly designed for malleable iron melting a definite firing schedule of coal and air proportions can be obtained, which results in uniform melting time, fuel ratio and analysis of metal. An example of a satisfactory firing schedule for the unit system of pulverizing is shown in Table IV.

Announces Program for Meeting of A. I. M. E.

Many important papers on nonferrous metallurgy will be presented at the annual meeting of the institute of metals division which will be held in connection with the annual meeting of the American Institute of Mining & Metallurgical Engineers in New York, Feb. 20.-23. Meetings will be held at the headquarters of the institute, 29 West Thirty-ninth street. The regular technical sessions will begin Tuesday afternoon, Feb. 21, when R. S. Dean will preside at a meeting on lead. The morning session on Wednesday will be devoted to papers on theoretical metallurgy and metallography, with Zay Jefferies presiding. At the same time a symposium on secondary metals will be held in another room with E. R. Darby presiding. The following papers will be presented at the symposium: "Nonferrous Secondary Metals Recovered in the United States", by J. P. Dunlop; "Sampling and Evaluating Secondary Nonferrous Metals", by T. A. Wright; "Classification and Preparing of Nonferrous Metals and Castings", by H. F. Seifert; "Contamination of Metal Scrap, Its Effect on the Value, and Suggested Means of Control", by Carl O. Thieme; "The Modern Nonferrous Secondary Metal Producer", by Don C. Blackmar.

The afternoon session will be devoted to a discussion of light alloys with H. W. Gillett as chairman. A paper on "Magnesium—Its Etching and Structure" will be presented by H. B. Pulsifer and one on "Aluminum-Beryllium Alloys" will be presented by R. S. Archer and W. L. Fink. In the evening the chairman of the division will hold a reception to members and this will be followed by a dinner at the University club. On Thursday morning, W. H. Bassett will preside at a meeting on copper. The following papers will be presented: "Manganese in Nonferrous Alloys", by M. G. Corson; "Alpha Phase Boundry in the Copper-Nickel-Tin System", by W. B. Price, C. G. Grant and A. J. Phillips; "Corrosion of Metals as Affected by Time and by Cyclic Stress", by D. J. McAdam Jr.; "Application of High Vacuum Induction Furnace to the Study of Gases in Metals" by P. H. Brace and N. K. Ziegler.

The iron and steel committee of the American Institute of Mining & Metallurgical Engineers will hold sessions on Monday, Tuesday and Wednesday of the annual meeting. Among the papers which will be presented at these sessions are the following: "Heterogeneity of Iron-Manganese Alloys", by C. R. Wohrman; "Critical Points in Chromium-Iron Alloys", by A. B. Kinzel; "The Constitution of the Iron-Silicon Alloys", by M. G. Corson; "A One-Ton Acid Open Hearth and Some Experimental Results", by C. E. Meissner; "Rate of Carbon Elimination and Degree of Oxidation of the Metal Bath in Open Hearth Practice", by A. L. Field; "Effect of Temperature on the Solubility of Iron Oxide in Iron", by C. H. Herty Jr., and J. M. Gaines Jr.; "Baily Furnaces for Synthetic Pig Iron", by E. Touceda.

A joint round table conference between the iron and steel committee of the institute and a committee of the American Foundrymen's association will be held Wednesday afternoon to consider a co-operative study of the effects of varying blast-furnace operations on the character of the pig iron made under changing blast furnace conditions and on the castings made therefrom. The conference, at which R. H. Sweetser will preside, is being held as a result of meetings on the same subject held at the Chicago convention of the American Foundrymen's association and the 1927 meeting of the American Institute of Mining & Metallurgical Engineers. Representatives of the United States bureau of standards and the bureau of mines will be present. Representatives of all interested organizations are invited to attend.

The committee on cast iron of the American Foundrymen's association will meet in Room 917 at 10 a.m. Wednesday, Feb. 22.

From a Photo Taken in the Eighties When the Five Brothers Were in Their Prime. Theodore, a Molder, Died in 1911

The Others Still Living are Julius, Upper Left; Albert, Upper Right; Louis, Lower Left, and Reynold, Lower Right

Complete Forty Years Service

Advancing Years and Expanding Interests Influence Survivors of Original Five Brothers to Abandon Jobbing Business

PARTNERSHIP of two brothers in business is not uncommon. A partnership of three brothers is not sufficiently rare to excite comment, but a business conducted by four brothers is something of a curiosity and those in which five brothers remained in peace and harmony for 40 years may be counted without the aid of an adding machine. One of these, in fact the only one that comes to mind is that of Pankow Bros., Sioux Falls, S. Dak., established in 1884, closed Jan. 1, 1926 and conducted, managed, operated and staffed during the entire life of the business by five brothers, Theodore, Julius, Albert, Louis and Reynold.

The oldest brother Theodore was a molder. The others were machinists and worked regularly in the shop. Early in the partnership, Louis became office man and that occupied all his time, except during an emergency when he grabbed hold of the work with all the vim and energy of the other members of the firm. In fact it was this spirit of mutual helpfulness, ignoring of all imaginary distinctions and the ability and willingness of each one to do any kind of work that carried the firm along peacefully and successfully for so many years.

Helped Build the Town

Sioux Falls with a present population of approximately 30,000, located on both sides of the river of the same name where it drops 100 feet in a series of cascades half a mile in length, presents quite a contrast to the little town of 3000 or 4000 population in which the Pankow brothers, Theodore, Louis and Albert established a modest business on leased ground in 1884. Pioneers of the West, they had faith in Sioux Falls and in South Dakota. They helped to build the town. All their investments are there. They own part of it. They are proud of their connection with the city and they don't care who knows it.

On the death of Mr. Pankow Sr., in 1886, two younger brothers Louis and Reynold joined the firm. Additional equipment was installed, property was bought outright and permanent buildings were erected and the working force was increased. Theodore died in 1911, Julius retired in 1914 and Albert retired from the business in 1916. These changes threw additional work on the two remaining partners who carried on until Jan. 1, 1926, when advancing age and responsibility of other interests prompted them to abandon the business. The equipment was scrapped and the building was rented to a plumber.

The survivors would have preferred selling or leasing the business as a going concern, but, as Louis Pankow remarks in commenting on this phase of the situation, most of the young people now are looking for jobs with easy money. Running a foundry involves hard work and presupposes the possession of backbone.

The brothers started the business in a small way with little capital but plenty of energy and enthusiasm. The country was new and they had to go slow, work to the best advantage, live within their means and work over time when necessary. Credit also is due their wives for working hand in hand and keeping personal and household expense within reasonable bounds. Only once was the firm pressed for money. At that time $1000 was borrowed for 60 days, but was paid off inside 30 days, from favorable collections.

In the early days the principal demand was for building castings, columns, lintels and plates. Later demand came for sewer manholes, water works castings, grate bars and railroad castings. Instead of the one little railroad of early days Sioux Falls now is a central point on five great railroads.

Found New Ideas

In a letter to THE FOUNDRY some time ago explaining why his subscription was not renewed Louis Pankow wrote: "We always have kept up with the times. When THE FOUNDRY first came to our office many years ago we knew a good thing and promptly placed our name on the mailing list. We have taken the paper continuously and read it regularly over a long period of years. If you look over your records you will find our subscription has been renewed without a break from the beginning up to Jan. 1, 1926. Although we were in the West we kept posted on current foundry practice and continually secured new ideas from THE FOUNDRY. We worked hard, took pride in meeting the quality of castings coming from the East. We frequently wrote to you direct for information. We never were refused or disappointed and our customers reaped the benefit in good castings."

Describes Sand Test Methods

Density, Bonding Strength and Permeability of Sand Are Determined on Samples Taken from Molds Made Under Operating Conditions

By Dr. A. Kessner

FOUNDRY technique, through numerous research investigations in industry and college laboratories and through gradual introduction of production methods in the works, has experienced a development which scarcely was foreseen. Extended lectures in various trade groups, and also excellently organized short courses for foundry methods in some especially well equipped colleges, have contributed to bring foundry technique more in the foreground of technical efficiency and scientific inspections, whose importance for all industrial branches becomes recognized much too late.

When one makes a study of the technical literature of foundry methods, he finds many pure scientific treatises, special chemistry, metallurgical or technological methods, descriptions of new foundry machines and equipment, etc. This signifies a furtherance of the insufficiently appreciated foundry methods at all technical institutions. Therefore, I direct your attention to a sphere which is dealt with comparatively little in literature, and which promises to become a successful method. This is a test which insures suitable compression and strength of sand for castings by various molding methods.

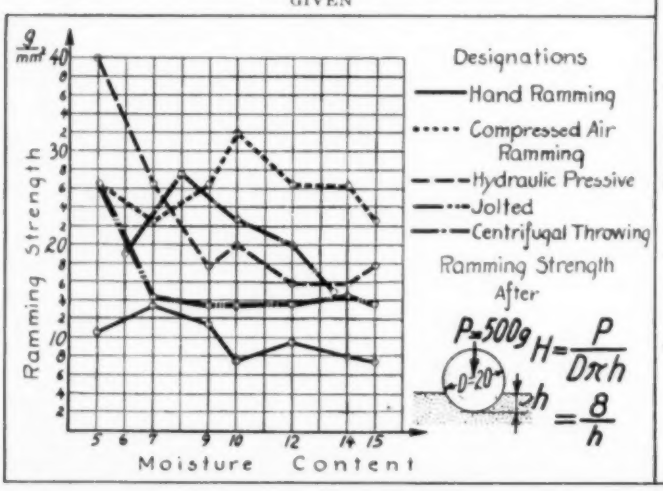
Let us consider first the molding sand, then the compression and then conclude with the test of sand strength. We require knowledge of three properties of molding sand, namely refractoriness, bond quality and permeability.

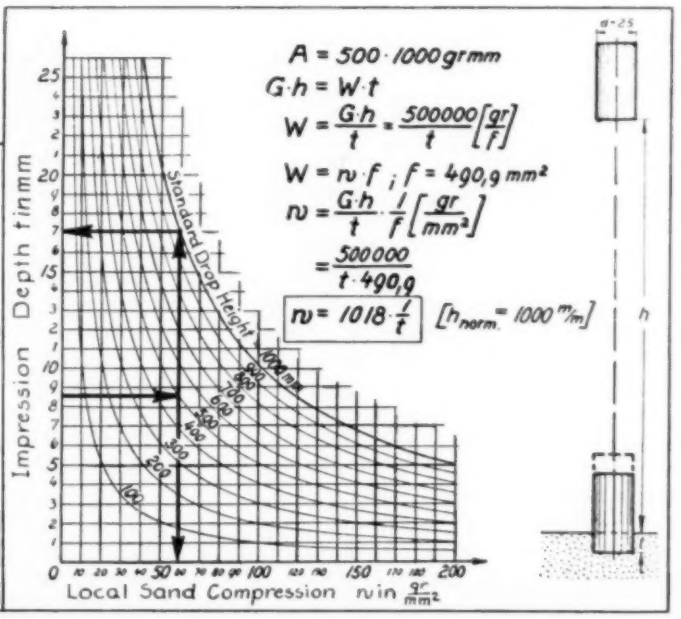
THIS article is abstracted and translated from a paper presented at the convention of the Verein Deutscher Eisengiesserein Giessereiverband which was held in Stuttgart, Germany, in June, 1927. Dr. Kessner, author of the paper, is director of the institute of technology, Technical university, Karlshuhe. The sand tests described are novel in that they may be performed on a mold without spoiling it in any way for pouring purposes.

Refractoriness essentially is dependent on the chemical composition; the bond on the clay content and moisture, and the permeability on the grain size, moisture and sand compression. Already much on the chemical properties and locations of useful molding sands is from reputable sources and has been used successfully. I remember only the treatises of Aulich, Roll, Doty and other investigators. On the testing of mold materials we have the works of Irresberger, Roll, Steinitzer, Treuheit. Also, the dissertations of Pannek, Breslau and Berghaus produced important results. The literature on sand compression by molding machines is extensive and I will refer only to the report of Lohse on American foundry methods and other similar works in presenting the subject of this article.

Curiously, only a few investigations on the degree of sand compression and its associated bond quality have been published, so that I feel it necessary to discuss these questions from a clear technological standpoint. Since the time for preparation of this article was short, I only can mention the important viewpoints and report on some researches which I jointly with my assistant Dipl. Ing. Rodehüser have made in some foundries.

FIG. 1—BELOW—RAMMING STRENGTH OF MOLDING SAND CONTAINING DIFFERENT MOISTURE CONTENTS. STRENGTHS WERE DETERMINED ON SANDS RAMMED BY FIVE METHODS USED COMMERCIALLY. FIG. 2—RIGHT—GRAPHIC ESTIMATION OF LOCAL SAND DENSITY WHICH WAS DETERMINED BY THE METHOD DESCRIBED. THE FORMULA ON WHICH RESULTS WERE BASED ALSO IS GIVEN




A = 500 · 1000 gr mm
G·h = W·t
W = G·h/t = 500000/t [gr/f]
W = rv·f ; f = 490,9 mm²
rv = G·h/t · 1/f [gr/mm²]
= 500000/t·490,9
rv = 1018·1/t [h norm. = 1000 m/m]
Impression Depth t in mm
Standard Drop Height
Local Sand Compression rv in gr/mm²
h

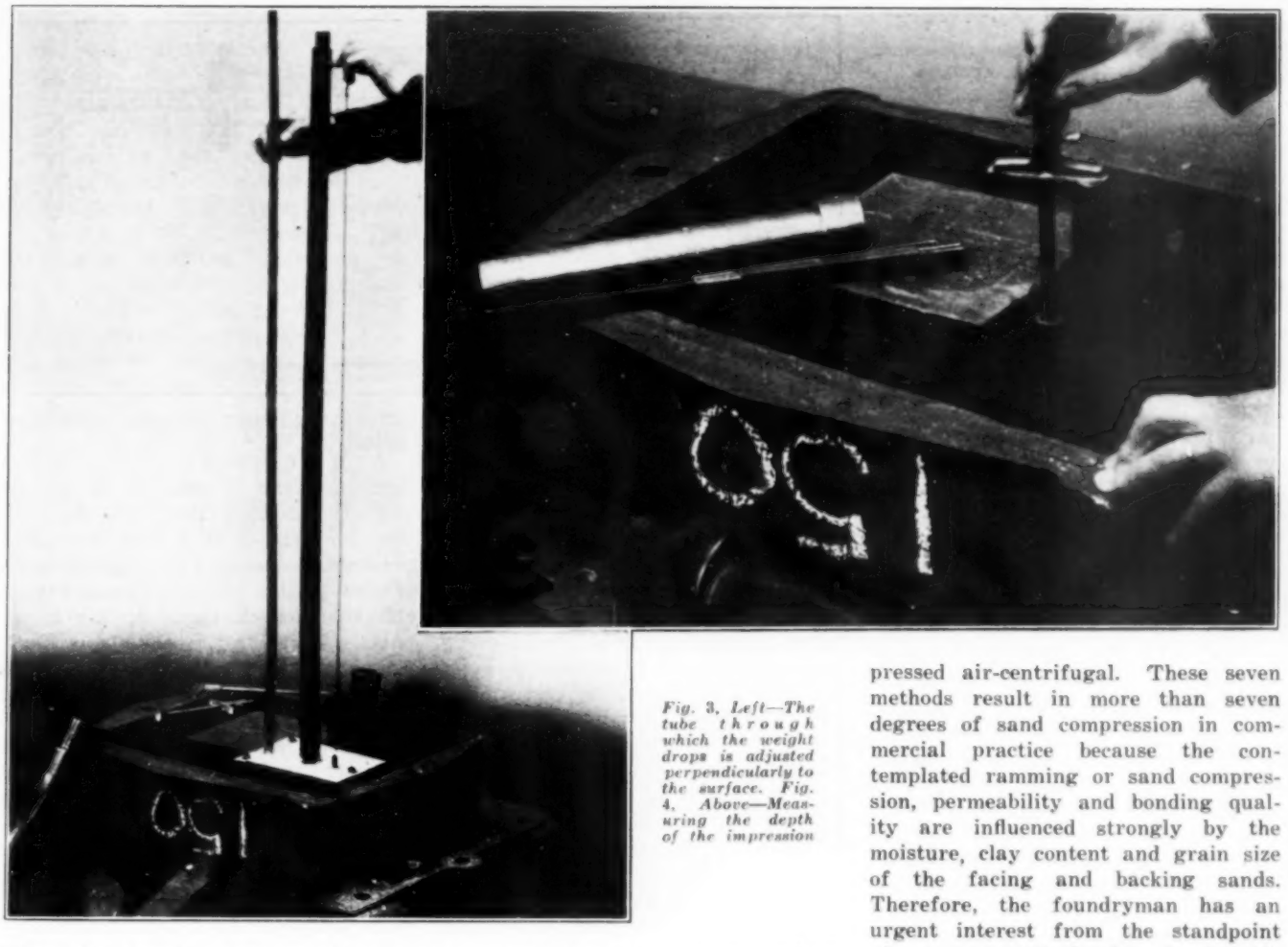


Fig. 3, Left—The tube through which the weight drops is adjusted perpendicularly to the surface. Fig. 4, Above—Measuring the depth of the impression

When the thumb print served as a measure for sand compression to the old foundrymen, the curve radius was as different with foreman and molder as the pressure exerted.

Naturally, an agreement seldom can be obtained upon the correct degree of sand compression or sand pressure with this subjective measuring method. Everywhere in industry one seeks to adjust the subject through the objective; but in many foundries the objective test of the molding sand and its compression hitherto has been considered as a kind of game or luxury.

When an experienced molder is observed at work, it is noticed that in spite of careful ramming the screened facing sand is compressed strongly around the pattern. The backing sand is rammed with the flat side of the rammer just enough to prevent it from falling out when the mold is lifted and rolled over. Later, when the molten metal flows into the mold, the rammed sand walls through hand or machine work must offer on one hand sufficient resistance, so that the casting does not swell—on the other hand the corresponding gases will not escape through the vents and channels pricked to facilitate their withdrawal. When the mold is removed from the pattern and always after the outside has been rammed denser, the gases in the molding sand finding a gradually increasing resistance, escape through the still fluid metal and later leave porous places and the casting becomes a waster. A correctly rammed mold must present the greatest density at the pattern edge and become gradually looser. Therefore, all mechanical means for sand compresssion must fulfill these conditions.

For sand compression the following methods have been employed: Hand molding, compressed air molding, hand squeezing, power squeezing, jolting, sand throwing and compressed air-centrifugal. These seven methods result in more than seven degrees of sand compression in commercial practice because the contemplated ramming or sand compression, permeability and bonding quality are influenced strongly by the moisture, clay content and grain size of the facing and backing sands. Therefore, the foundryman has an urgent interest from the standpoint of proper sand density, to investigate and to employ suitable methods for its test in the works.

Steinitzer, *Stahl und Eisen*, 1907, and Doty, THE FOUNDRY, 1923, have described testing methods for specially prepared specimen bodies. However, it appeared to me that these specimen bodies could be eliminated and the tests applied to commercially finished molds. Only three methods of measuring the sand compression in finished molds are in use: That employing a weighted three-legged frame developed by Berghaus, "Kritische Betrachtungen zur Sandauflockerung und Sandverdichtung beim Formmaschinenbau"; that similar to

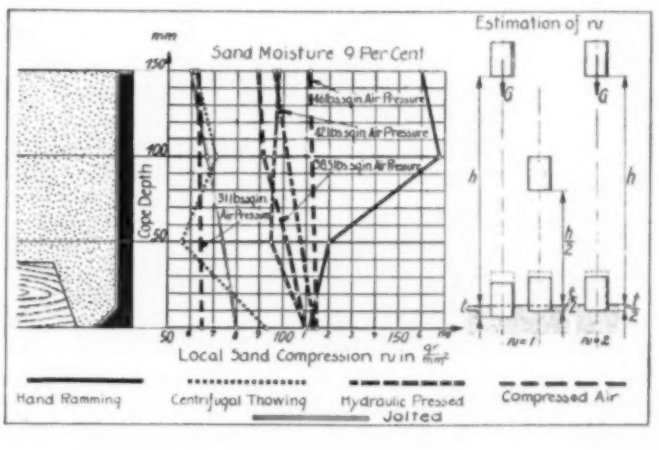


Fig. 5—Local sand density obtained by various molding methods. All sands contained 9 per cent moisture

the brinell type sand tester as described by Treuheit, *Die Giesserei*, 1923; and the simple test of Roll.

Berghaus places a three-legged frame upon the finished mold, the three feet possessing a surface of three square centimeters. As soon as the weight of the three feet penetrates into the sand with gradual imposition, he measures the strength pressure in kilograms per square centimeter. An especial arrangement of Hebeln should allow the instant of penetration to be recognized easily. With this somewhat troublesome apparatus, Berghaus ascertained an average pressure strength of 1.6 kilograms per square centimeter for hand molding and 1.5 kilograms per square centimeter for machine molding.

Figures Are Comparative

These measured degrees of ramming strength of molds are only comparative and not absolute figures. Treuheit has discovered a ramming strength test which rests upon the same principle as the well-known brinell test for estimating the hardness of metals. A ball of 20 millimeters diameter with a 500 gram load produces an impression of definite depth which can be read to a precision of 1/100 millimeter for each degree of sand compression of a mold or a core. From the depth t the hardness figure H of the sand in grams per square millimeter is obtained from the equation:

$$H = \frac{P}{2r\,\pi h}$$

A table advantageous for computation is prepared in which the corresponding ramming strength can be read in grams per square millimeter from the depth t found. From long years' experience through works' research Treuheit has drawn up standards suitable for sand strengths of thick and thin-walled castings in green or dry sand which he checks with his measuring instrument. The handy apparatus may be placed easily on each surface and mold, but is of such sensitivity that a difference from 3 down to 0.01 grams per square centimeter may be discerned; thereby considerable range results. In an extended research Treuheit, *Stahl und Eisen*, 1927, has measured ramming strengths in grams per square millimeter on horizontal and perpendicular mold surfaces made by various compression methods and with moisture contents from 5 to 15 per cent.

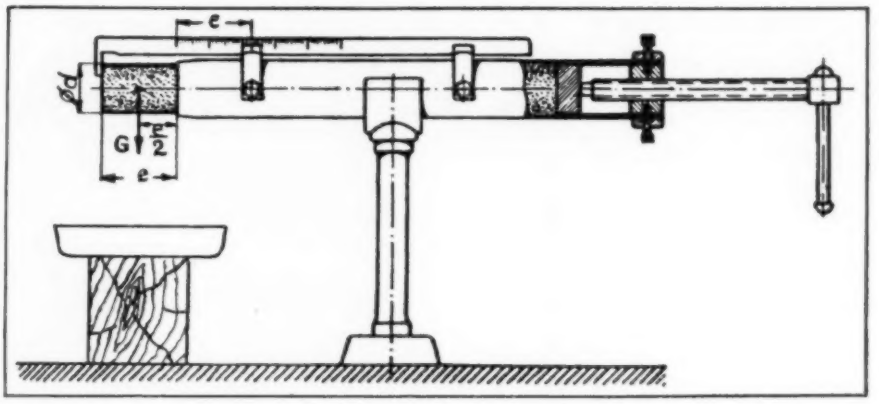


FIG. 8—SIMPLE APPARATUS USED FOR DETERMINING THE BONDING STRENGTH OF THE SAND

The averages are arranged as a curve in Fig. 1. In comparison with the hand rammed molds that properly ought to hold good as standards, it is pointed out that other sand compression methods, for example that of hydraulic pressure, have a much higher ramming strength which especially in green sand molded castings may lead to wasters as the result of scab formation. An explanation for this is that with hydraulic pressure the sand at the highest parts of the pattern becomes pressed considerably firmer than on the lower parts. Therefore, to obtain an equal pressure a profile block must be used before the final pressing. Nevertheless, the pressure is too firm and denotes an unnecessary waste of force and a reduction of the permeability. This drawback necessitates an alteration of the molding machine. Further, Fig. 1 shows that all moisture contents are considerably higher with machine ramming than with hand ramming.

Designs Another Tester

Dr. Roll has introduced another sand compression test in which a pointed ball is pressed into the mold by a spring, and from the depth of penetration a measure of the sand compression is obtained. This little apparatus which the foreman may carry in his pocket is handy and may

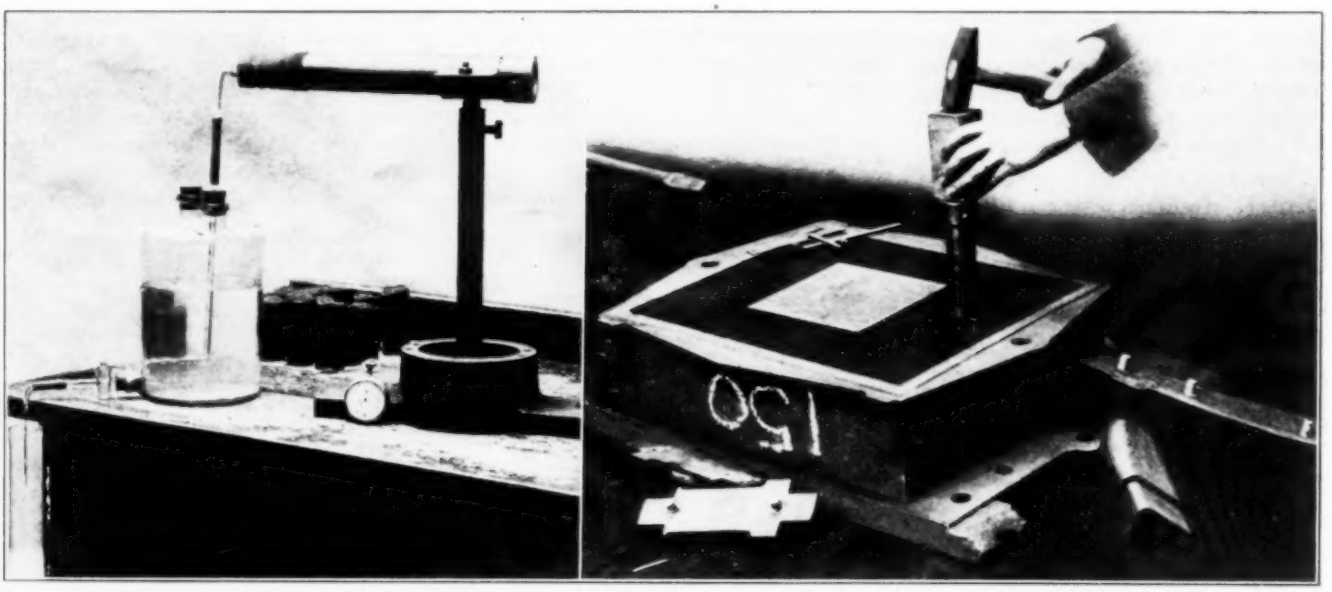


FIG. 6—SHOWING THE METHOD OF OBTAINING THE PERMEABILITY OF THE SAND WHICH IS TAKEN FROM THE MOLD BY THE BRASS TUBE MOUNTED ON THE STAND. FIG. 7—TEST SAMPLES ARE REMOVED BY DRIVING A THIN SHELL-BRASS TUBE INTO THE MOLD

be applied at any convenient place on the mold.

Starting with the idea that all measuring methods and tests for the foundry must be as simple and cheap as possible, we have employed a simple tube through which we dropped a 0.5 kilogram weight from a height of 1 meter in our investigations. The accumulated potential energy $A = G \times h$ will be consumed in impressing the weight in the rammed sand. This penetration to the depth t is opposed by the resistance W. Since

$$A = G \times h = W \times t$$

then

$$W = \frac{G \times h}{t}$$

The calculated specific resistance

$$w = \frac{G \times h}{t \times f}$$

in grams per square millimeter on the unit surface is simultaneously a measure for the resulting local sand pressure.

With the chosen measurements: The falling weight G is 0.5 kilograms; diameter d is 25 millimeters, and the height of fall h is one meter. The local sand compression is calculated from the equation

$$W = 1018 \times \frac{1}{t}$$

in grams per square millimeter.

Obtains Data

With the same weight, the local sand compression at various heights of drop were determined and the corresponding curves are presented in Fig. 2. Therefore, if at a height of drop $h = 1000$ millimeters, a penetration depth $t = 17$ millimeters is measured, the localized sand compression $w = 60$ grams per square millimeter. With an equal w one should obtain $t = 8.5$ millimeters when $h = 500$ millimeters. Fig. 3 shows the method of carrying out the investigation and Fig. 4 the method of obtaining the penetration depth t with a simple depth measure after removal of the dropping tube. Fig. 5 represents some investigation results on a cope 150 millimeters deep. The sand in the cope was compressed by five various methods. To obtain comparative values, the moisture of the molding sand in all investigations should be the same, and was 9 per cent. The measurements with Rodehüser's dropping tube were determined at four different heights; at the pattern bottom, at 50, 100 and 150 millimeters high. Consequently, the sand in the cope was dug out to 50 and 100 millimeters.

Hand ramming measured as an average with different rammings by an experienced molder gave the strongest and most irregular sand compression. At the pattern bottom, the sand was compressed 112, above the pattern 120 and at the top as much as 160 grams per square millimeter. Irregular values also were obtained from the centrifugal sand throwing machine and hydraulically pressed copes. Jolted copes showed a uniform loss of sand compression from the pattern bottom upward from 80 down to 60 grams per square millimeter. Therefore, gave values which essentially were lower than hand ramming and hydraulic pressing.

The desired decrease of sand strength from the pattern upward was obtained on molds made with a new method developed by the Badische Maschinenfabrik, Durlach, using a combination of centrifugal and compressed-air, sand throwing. After the first trial ranges suitable sand compression appeared to be produced with compressed air at 37.5 to 42 pounds per square inch pressure.

Determine Permeability

We determined the permeability of commercially produced molds with the method of Steinitzer which measures the time necessary to draw 200 cubic centimeters of air through a sand test piece. To this end a sand test piece was cored out from the mold with a sharpened thin tube with an inside diameter of 36 millimeters. It was connected by a rubber tube to a wolff flask as shown in Fig. 6. To obtain a constant suction, the mariotte tube leading down was terminated in a 2 millimeter constricted opening nearly 50 millimeters above the outflow cock.

Besides the ramming strength by Treuheit's method or the local sand compression by the dropping test, the binding strength of the molding sand is essential. Treuheit determined it by ramming a core piece 400 x 100 x 50 millimeters from the sand used, in a special corebox by

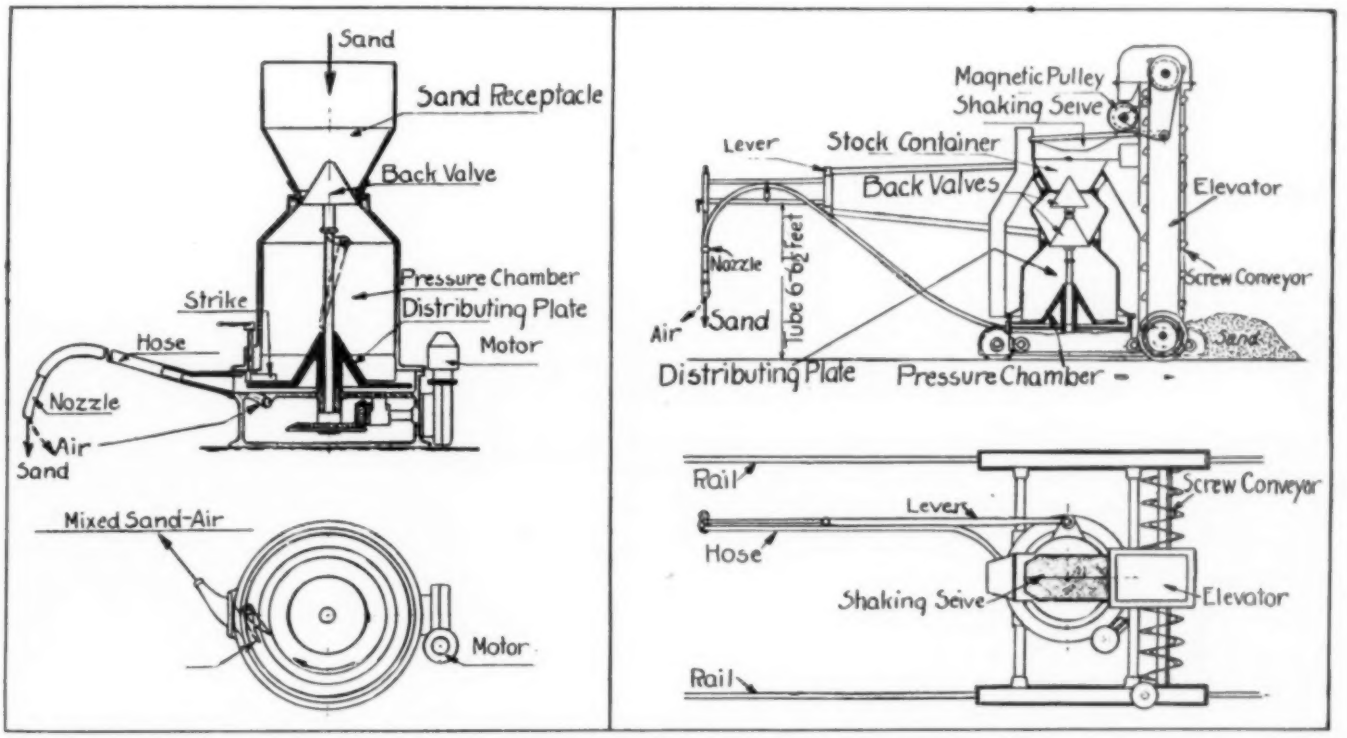


FIG. 9—SCHEMATIC REPRESENTATION OF STATIONARY TYPE OF THE NEW TYPE MOLDING MACHINE. FIG. 10—THE SELF-PROPELLING TYPE HAS A SCREW CONVEYOR AND ELEVATOR TO CARRY THE SAND TO THE MACHINE

the different customary compression methods used in practice. The core mold is covered with oiled paper and glass plate, turned over and the sand core abstracted without essential shock. The sand prism then is shoved forward over the edge of the glass plate with a constant speed of 2.86 centimeters until it breaks off. The broken piece is caught on a plate and weighed. The weight of the broken section divided by the cross sectional area gives the bonding strength according to the equation:

$$\frac{B = G}{F}$$

in grams per square millimeter.

With our trials we have estimated the bonding strength on a sample cored out of the mold with the shell shown in Fig. 7. This was forced out carefully by a spindle until it broke off as shown in Fig. 8. The bending strength of the sand column was calculated according to the law of mechanics as follows:

$$M_b = G \times l = W \times s_b \text{ and}$$

$$\frac{G = \pi \times d^3 \times l \times n}{4}$$

where n = mass and W = 0.1 d^3 for circular cross section. With d = 36 millimeters the equation becomes:

$$s_b = 0.11 \times l^3 \times n$$

Conformable values were obtained on commercial molds tested under similar test conditions with these simple methods. Moisture contents of the different mold materials and their mixtures are stated in parts per 100 after weighing before and after drying at 105 degrees Cent. The trials were continued in several foundries; a detailed report of which will appear as a dissertation by Rodehuser.

In conclusion I will refer to the different sand compression methods and believe it can be made short as you as foundry engineers have had your own experience with them. Therefore, I will direct your attention only to two sand compression methods on which the special interest of the foundrymen will be centered next. These are the American sand-throwing machine made by Graue Aktiengesellschaft, Hannover, and the compressed air, air-centrifugal molding machine made by the Badische Machinenfabrik, Durlach. The first mentioned is based upon the principal of a quickly rotating hand which throws nearly 700 to 1500 sand balls with a speed of 65.6 to 164 feet per second into the mold per minute. During trials with a machine of this construction at the Lanz Maschinenfabrik, Mannheim, we have measured 1300 to 1500 revolutions per minute and from this an average throwing speed of nearly 65.6 feet per second was calculated. The throwing head throws the sand against a densening elbow where it experiences the first compression. As soon as the sand leaves the densing elbow at the rotation of the throwing hand, it flies out to the throwing head and from there to the mold.

Made in Three Types

The machine is built in stationary, portable and self-propelling types. The stationary sand thrower is designed principally for works in which molding sand conveying apparatus is provided. The molding sand should be supplied from above. A shaking sieve mounted upon the rotating headarm removes the large pieces and foreign bodies while the screened sand falls upon a conveyer and is led to the throwing head.

The self-propelling sand thrower moves upon two rack and pinion rails 13.12 feet apart and carries the molding sand to an elevator by a screw conveyor placed in the center of the track. The elevator conveys the sand to the shaking screen and from there to the throwing head. While sand compression with the sand thrower results through separate small quantities of sand which correspond approximately to what a molder could grasp in his hand and throw. The new compressed-air, sand throwing machine of the Badische company is based upon the principle of throwing a sand-air mixture through a pressure nozzle which separates the air from the sand and the sand is thrown into the mold in uniform, close streams.

The machine is represented schematically in Fig. 9 and consists essentially of a pressure chamber with a sand receptacle above. The pressure chamber is said to mix the molding sand and compressed air under pressure with the aid of a mechanically operated distributor. An exterior, suspended guide allows the quantity of sand to be regulated exactly. This sand-air mixture passes in an unbroken stream through a rubber hose to a blast nozzle of special construction in which each little sand particle is given the same velocity and is separated from the compressed air. On meeting the mold, the active force of the sand quickly is converted into compressive work so that a mold ready for pouring is obtained in which hand ramming is unnecessary.

With the machine we have measured the following performances: With a pressure of 37.5 pounds per square inch, 19.62 cubic yards of compressed sand per hour; with 45 pounds per square inch, 39.23 cubic yards per hour and with 52.5 pounds per square inch pressure, 58.85 cubic yards per hour.

The figures are not limiting values. By increasing the pressure and the quantity of supplied sand a further increase in performance is to be expected. With this machine easy handling of the distributing tube and of the movable lever especially is noticed.

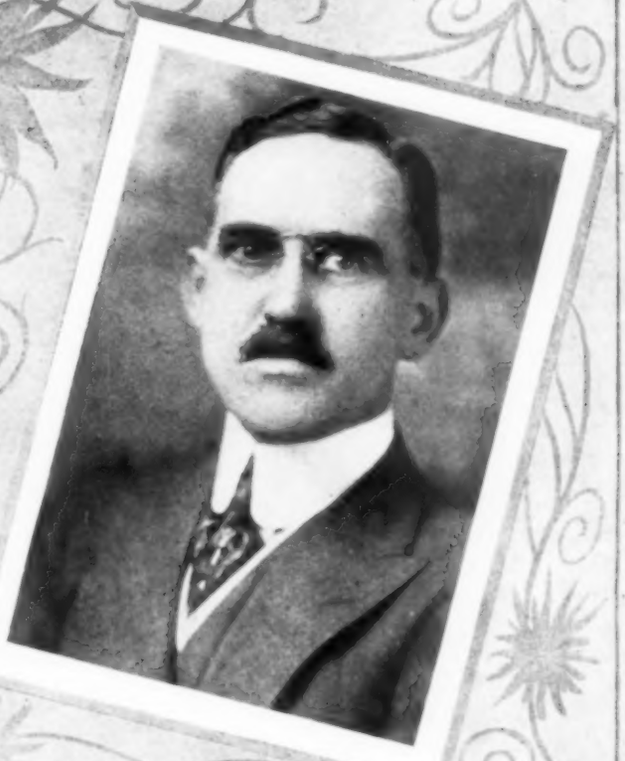
In consequence of the ease of movement of the nozzle in every direction, the sand can be thrown vertically, obliquely, or from below, so that good sand compression will be obtained on steep walls and under the bars of the flask. Besides a uniform sand density will be obtained (compare Fig. 5) which with each hand ramming decreases. Through a change of air pressure and the mixing relation between sand and air, the sand density can be adapted to the sand condition and changed within wide limits to meet requirements of various sections of the mold. Therefore, fat and lean sand may be worked up in the machine without trouble. Essentially, the sand conveyed through the air stream is loosened completely and thereby preparation becomes simplified.

Operating radius of the machine is exceptionally great as after the recent trial a tube length up to 65.6 feet may be adopted without further trials. Heavy motors and moving machine parts in the movable lever are avoided so that attendance of the machine is simple and not tiring. Wear appears at the nozzle which generally is shown as a simple construction part which easily may be interchanged. Fig. 10 shows a practicable compressed-air, sand-throwing machine.

In conclusion may I emphasize again the need of adopting this simple and reliable test method besides the otherwise customary works control which can become an important support to the works management.

Open competitive examinations for an associate metallurgist and an assistant metallurgist have been announced by the United States civil service commission, Washington. Optional branches for these positions are ferrous, nonferrous and physical metallurgy and ore dressing. Applications must be on file with the commission at Washington not later than Feb. 21.

The FOUNDRY Family Photograph Album



Upper Left

W. B. PRICE,
Scovill Mfg. Co.,
Waterbury, Conn.

Lower Left

W. H. GOLDSTINE,
Flint, Mich.

Upper Right

C. B. CARTER,
Alloys Foundry Co.,
Chicago

Lower Right

S. C. VESSY,
W. W. Sly Mfg. Co.,
Cleveland

A LEXICON OF TECHNICAL TERMS

By O. W. Potter

(Continued from Data Sheet No. 702)

Thermal Properties

Many properties are due to temperature change, transmission of heat, or the consumption or evolution of heat. The measure of heat is the calorie in the metric system and the British thermal unit in the English system.

The *calorie* is the amount of heat required to raise one gram of pure water one degree centigrade.

The *great (or large) calorie* is the amount of heat required to raise one kilogram (1000 grams) of pure water one degree centigrade.

The *British thermal unit* is the amount of heat required to raise one pound of pure water one degree Fahrenheit.

One *great calorie* = 3.968 B.t.u.

Freezing Point (Temperature)

The temperature at which a liquid changes from the liquid to the solid state upon cooling.

The freezing point and the melting point are the same for wrought iron. This also holds for steel and malleable white iron.

The freezing point for gray cast iron and semi-steel is about 90 degrees lower than the melting point.

When the entire alloy or substance freezes or solidifies at a constant temperature it is said to be *congruent freezing* or *isothermal freezing*. If different freezing points occur it is called *incongruent freezing* and the temperature where freezing commences is called *upper freezing point* (or beginning of freezing) and where it is completed is called the *lower freezing point* (or end of freezing) and the range of temperature the *freezing range* (solidification).

Critical Temperature or Range

Critical Points, Arrestation Points, Transformation Points, or Transition Points

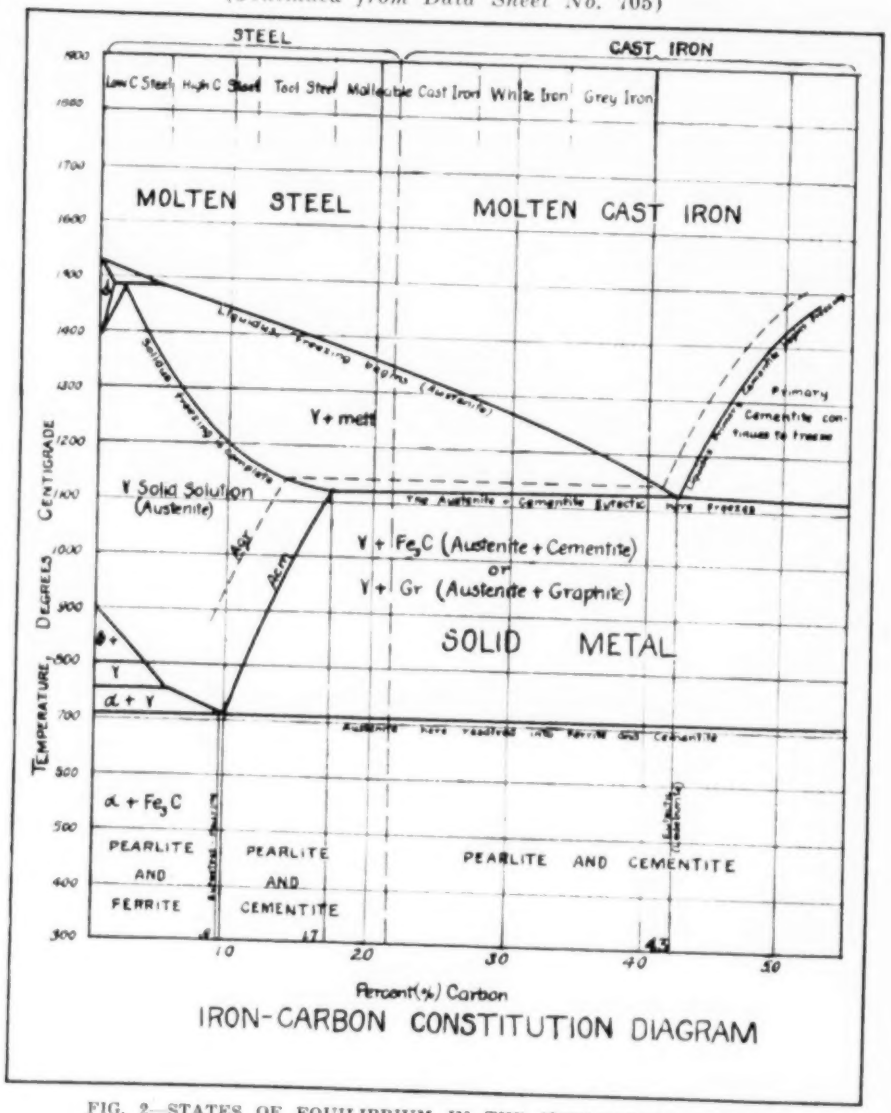
Temperature of transformation in solids, that is, the temperature at which there is some physical change in the substance which is evidenced by an absorption or liberation of heat. (See iron carbon constitution diagram under melting points).

There are three such points in the alloys of the iron carbon series, the A_1, A_2, and A_3; the A_1 being the lowest temperature, A_2 the next highest, etc. On account of molecular inertia or lag, the temperature of any criti-

(Continued on Data Sheet No. 706)

A LEXICON OF TECHNICAL TERMS

(Continued from Data Sheet No. 705)



IRON-CARBON CONSTITUTION DIAGRAM

FIG. 2—STATES OF EQUILIBRIUM IN THE IRON-CARBON SYSTEM

(Continued on Data Sheet No. 707)

THE FOUNDRY DATA SHEET, FEB. 15, 1928
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Metals and Melting

How Metallurgical Problems Have Been Solved in Gray Iron, Malleable and Steel

Makes Smelter Castings

Question: We would appreciate the favor if you would kindly advise a proper mixture of iron for use in making slag pots, copper bullion molds and crusher plates for use in copper smelters. We make considerable of these and at times have difficulties due to not giving sufficient service as they receive hard usage in a smelter which is smelting about 900 tons of mineral a day.

Answer: We suggest the following analyses for the castings indicated:

SLAG POTS

Silicon, 1.25-1.75 per cent; sulphur, under 0.06 per cent; phosphorus, under 0.30 per cent; manganese, 0.60-1.0 per cent, and total carbon, 2.75-3.00.

COPPER BULLION MOLDS

Silicon, 1.50-2.00 per cent; sulphur, 0.06 per cent; phosphorus, 0.20 per cent; manganese, 0.80-1.00 per cent; total carbon, 3.00-3.25.

CRUSHER PLATES—I

Silicon, 0.70-0.90 per cent; sulphur, 0.08 per cent; phosphorus, 0.20-0.40 per cent; manganese, 0.70-0.90 per cent; total carbon 3.00-3.50 per cent, and chromium, 0.60-0.80 per cent.

CRUSHER PLATES—II

Silicon, 0.80-1.00 per cent; sulphur, 0.08-0.10 per cent; phosphorus, 0.20-0.40 per cent, and manganese, 0.81-1.20 per cent

Low total carbons are suggested because the castings will have a fine grained, dense structure. In analysis I, for crusher plates chromium is used for an alloying metal. This will produce a hard structure that will resist the wearing action that the plates receive. Chromium also may be used in the other castings with excellent results, and is especially desirable where heat resistance is required.

Wants Mold Analysis

Question: We make a number of cast iron molds for pouring brass slabs for rolling mills. We experience considerable difficulty due to cracks appearing a short time after being used. Could you advise us as to the proper mixture to use for molds for this purpose?

Answer: The following analysis is suggested for cast iron molds for brass slabs: Silicon, 2.0 to 2.25 per cent; sulphur, 0.08 to 0.10 per cent; phosphorus, 0.2 to 0.4 per cent, and manganese, 0.6 to 0.9 per cent.

Elements Affect Iron

Question: Will you give us the proper analysis for agricultural machinery castings and state the effect of the various elements on gray cast iron?

Answer: The following analyses will cover the various classes of agricultural castings:

Element	Very thin	Thin	Medium	Heavy
Silicon	2.75	2.50	2.25	2.00
Manganese	0.60	0.60	0.70	0.80
Phosphorus	0.80	0.75	0.70	0.60
Sulphur	As low as possible			
Total Carbon	3.75	3.75	3.50	3.25

Silicon reduces the solubility of carbon in cast iron, and it is by controlling the amount of silicon in the iron that the combined carbon and graphite are regulated. Low silicon irons are white in fracture due to most of the carbon being in the combined form. High silicon irons up to 4.00 per cent, are gray or blackish because the silicon causes a precipitation of graphite or uncombined carbon.

Sulphur has the tendency to cause hardness by increasing combined carbon. Generally it segregates when high and forms hard spots although the writer has experienced sulphur as high as 0.120 per cent in thin castings — radiator sections — without any trouble in machining or undue cold shuts. Sulphur makes castings tender when at red heat.

Phosphorus lowers the resistance to shock or impact. It promotes fluidity. It may cause difficulty in machining especially if segregation takes place.

Manganese increases the solubility of carbon in cast iron. It has a great affinity for sulphur, forming manganese sulphide some of which goes into the slag and some remains in the iron. The manganese sulphide forms spheriods and for this reason is not as harmful as the plate-like iron sulphide which causes planes of weakness. Above 1.00 per cent, manganese may combine with the iron and carbon to form a hard granular compound that gives much trouble in machining.

Iron Melted in Crucible

Question: Can gray cast iron be melted in a furnace designed for melting brass using coke and crucibles? If so, could you give me information as to the procedure to follow?

Answer: Gray iron may be melted in a crucible. The melting point of gray iron is from 2050 to 2300 degrees Fahr., and that of copper is 1981 degrees. This temperature is attained easily with a good hot fire. The only difficulty that we can think of will be breaking up the pig iron small enough to charge into the crucible. We suggest melting the scrap first as it will be in smaller pieces and then add the larger pieces of pig. You could use all scrap iron, except for the fact that the sulphur averages around 0.12 per cent, and the silicon is low.

To obtain the best results the analysis of the metal should conform to certain specifications, and as you do not state what the castings are to be used for, we cannot give you the proper analysis for specific castings. For machinery castings we suggest:

	Light	Medium	Heavy
Silicon	2.50	2.00	1.50
Sulphur	As low as possible		
Manganese	0.60	0.80	1.00
Phosphorus	0.70	0.60	0.50
Total Carbon	3.75	3.50	3.25

Objects to Low Sulphur

Question: I recently had an analysis made of a casting and it was reported as follows:

	Per cent
Silicon	2.27
Sulphur	0.054
Phosphorus	0.575
Manganese	0.52
Combined carbon	0.55

In a letter accompanying the analysis the engineer stated that the sulphur was so low that it might cause blow holes. I would like to know whether this is true.

Answer: Low sulphur in iron should not cause blow holes, although in heavy sectioned castings iron with sulphur as low as 0.05 per cent would have a tendency to increase the internal shrinkage and thus cause spongy spots in the iron at places. However, if this iron was melted in a cupola we doubt the correctness of the sulphur analysis.

Bill Discusses Charging the Cupola

By Pat Dwyer

SAY," said Bill the other night, apropos of nothing in particular so far as I could see, "do you believe in dreams?"

"What do you mean believe in dreams?" I naturally inquired. "You have a gift for asking the most ambiguous questions. Suppose I was to meet you on your own ground and simply answer yes and no, how would you like it, hey?"

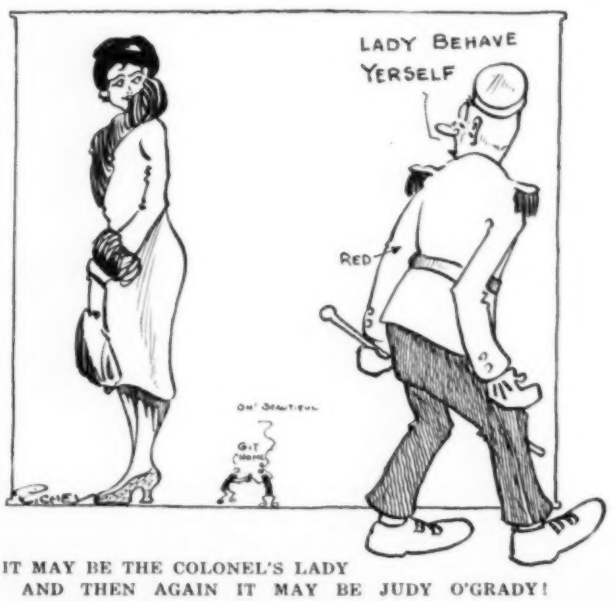
"Suits me," said Bill. "In fact I kind of expected a shifty answer to my plain, simple question. Why can't you come out boldly like a man and say either yes or no? I see nothing ambiguous about the question. Either you believe in dreams or you do not believe in them. I suppose with your aggravating method of corkscrew reasoning you will come out next and tell me that you have a clear and unsullied conscience and therefore you never dream. That's all my eye. If you never dream that simply is an indication that your mind is dead or permanently crippled. Instead of bragging about your immunity you should be ashamed to admit that you are not hitting properly on all six cylinders. You should have your spark plugs examined." "Bill," I said, "strictly among ourselves, man to man, you give me a severe pain in the diaphragm. That's a rather neat poetic touch, probably over your head, but I trust I make my meaning clear. Coming right down to bed rock, hard pan, brass tacks or what have you, what do you want to know? Are you asking me (a) if I believe that human beings dream, or (b) do you want to know if I attach any significance to dreams? In other words, do I believe that the miscellaneous assortment of fantastic and generally unrelated pictures that float through a man's mind when he is asleep bear any relation to the activities of other members of the human race? More specifically, do they foreshadow coming events? 'If your question deals with the first phase I am happy to say I can lay my hand on my—well not exactly my heart, that is a physical impossibility—let us say the general vicinity of my wishbone—and answer you yes in all sincerity.

"If your single track mind is interested in the second phase of the question, then I am here to tell you, young-fella-me-lad, that my answer delivered in a fine, manly voice, feet spread well apart and so forth, is a loud and unqualified, NO! Them's my sentiments! Nailed to the mast head they are and I'll sink her and take every man Jack to the bottom before I'll change a line, a word, a letter or a punctuation mark. Ha-ha-ha (Sneery laugh)."

"Put on your bathing suit," Bill remarked calmly, "you are going down in about a minute. I am sorry for the fish. You probably will poison them. One night recently I was carried back in a dream to a steel works foundry in which I worked more than 25 years ago. All the old gang were there including an ex-British soldier, who had a long running job on the foundation plates for the hydraulic pushers on top of the soaking pits in the blooming mill. This lad, quite a character in his way, figured prominently in the dream and the following day I wondered idly several times if he still was in the land of the living or if he had met the fate pictured in the dream.

"Now—here is where you brace yourself—today I had a letter from an old friend down that way announcing among other items of more or less personal interest, that the gallant old soldier had answered the last roll call during the preceding week. I rather fancy, me boy, that will tie a kind of a fancy knot in your lofty mast head stuff and cause you to revise some of your stiff necked opinions based on nothing more substantial than lack of personal experience on this subject of dreams."

"Merely a coincidence," I remarked carelessly. "Merely a coincidence. Might not happen again in 100 years. You will have to advance a more convincing argument before I change my opinion of dreams and portents of the same general character. The only point on which I am curious is how this man happened to write you. Do you mean to tell me you keep up a correspondence with men in every town in which you worked?" "Not likely," Bill grinned. "I did not stay in some of the places long enough to get acquainted. Even the names of many more or less thriving hamlets in which I lingered for brief periods, long since have slipped my mind. This particular case is an exception to the general rule. I worked with this man twice and my experience is an interesting example of the manner in which a man's views change with the advancing years.



IT MAY BE THE COLONEL'S LADY
AND THEN AGAIN IT MAY BE JUDY O'GRADY!

In the first period I hated him bitterly, while in the second I developed a sincere regard for his many sterling qualities and as a result have kept in touch with him ever since.

"Perhaps one of the reasons is his rugged honesty. He is plain and straightforward, blunt in his speech, with a proper appreciation of his position as a citizen, free, white and over, quite over, twenty-one. One of that class of men known in intimate, friendly and homely phrase as salt of the earth. The kind of men Longfellow had in mind when he took his trusty pen in hand to describe the inhabitants of the peaceful village of Grand Pre before their shameful expulsion. 'Alike were they free from fear that reigns with the tyrant; and envy, the vice of republics.' First contact came in the fourth year of my apprenticeship when he came to work as a star molder. I was doubled up with him and in my self-sufficiency and youthful conceit resented what I considered unnecessary advice and interference. In after years when I found myself in a similar position to his with half baked young cubs, I realized the honesty and sincerity of his motives. All I could see was his bossy attitude. Several flare-ups ended in a violent row. The old gaffer separated us and thereafter we worked on different floors and exchanged nothing but hard looks with each other until I left home to see the world. I promptly forgot all about him.

"Several years later I met him in a new shop. He held out his hand with a friendly grin and I met him just as cordially. The hatchet was buried right there without a word and never has been mentioned since. We became quite intimate and what is more remarkable this free, comradely attitude continued after I assumed charge of the shop some time later.

"He retired from active service some time ago, but once a year about the Christmas season he writes me a long gossipy letter principally about conditions in the foundry and the sayings and doings of many of the men of my time who still are there.

"The old soldier to whom he referred in his recent letter had quite an adventurous career in many quarters of the globe. He was as gabby as a magpie and my own private impression is that if a contest was staged between the two, the magpie would stick closer to the truth. He was a good workman and during working hours attended strictly to business, but at noon time with a gang of appreciative listeners sitting around one of the salamanders, he gave his imagination free rein. He had a pronounced English accent and a lurid barrack room vocabulary years and years ahead of anything I ever heard on this side of the Atlantic. Captain Flagg in *What Price Glory* was a cooing dove in comparison.

"Filled with smuggled liquor and patriotism shortly after he had served his apprenticeship in the foundry, he accepted the queen's shilling and promptly was shipped off to Africa where a perishin' blister known as the Madhi had every bushy headed fighting man north of the equator on the bleedin' war path. These birds had conceived the most violent dislike for everything British and earnestly had set themselves to the task of carving the soldiers of the queen into small pieces.

FANCY! FIGHTING OVER AN EMPTY BUCKET!

"Aided by pestilence and famine they had just concluded a rather complete job of totally wiping out Chinese Gordon and his heroic garrison at Khartoum, when our hero arrived on the scene. Before these misguided people finally were made to see the error of their ways he estimated that he had marched at least 1,000,000 miles and had absorbed enough desert sand to fill a one-horse dump cart.

"Routine features of military life were dismissed briefly. Occasionally he commented on one of his many miraculous escapes from hunger, from thirst, from wild animals and still wilder black men armed with spears, also high powered rifles, and who displayed the most fiendish ingenuity in selecting times and places for attacking her most gracious majesty's forces located in that territory.

"His favorite topic was love—companionate love. According to his own account he was invincible and only had to crook his finger to have women eating out of his hand. Almost invariably he had to contend with annoying rivals and his spirited accounts of tilts with these gentlemen seemed to indicate that he derived as much pleasure from beating them up as he did from worshipping at the shrine of Cupid.

"His stories of his prowess as a gay Lothario may or may not have been true, but he staged a demonstration one day which left no doubt in any person's mind, fortunate enough to be present, that he was a first-class fighting man. One morning he had a few words with a swaggering young ruffian who attempted to take his water pail. One word led to another after the manner of many rows that start from the most trifling incidents. The young fellow who enjoyed some local reputation as a slugger, taunted the older man with slighting reference to many of his stories and finally challenged him to mortal combat during the noon hour. The soldier promptly accepted and cheerfully advised the young fellow to notify the office where to send the gory remains. Immediately after the whistle blew the entire shop crew escorted the two gladiators to a nice, level grassy plot in the yard. They were fairly matched in height and weight, but showed a marked contrast when stripped for action. The soldier's body beautiful in its masculine symmetry, was as smooth and apparently as hard as white marble. Unsightly pimples and a certain amount of flabbiness indicated the slugger's dissolute habits. He had youth and strength on his side and he was fighting mad, but he didn't have any more chance of winning than the well-known celluloid cat who essayed a certain journey without claws.

"He used up all his energy carrying the fighting into the enemy's territory. The enemy, either through a natural gift or as a result of many years of iron discipline, perhaps both, handled the job as he would any routine part of the day's work. He did not lose his temper. In fact he seemed to derive a certain amount of pleasure from the exhibition. He seemed to experience no difficulty in hitting the slugger when and where he pleased.

"After it was over he modestly admitted he could have finished the

bout in the first round, but he wanted to teach the perishin' young scut a proper lesson. He lashed into him unmercifully for three rounds and then after the manner of the stage boxer who hits the punching bag one last lick that lands it out among the spectators, he came up under the lad's chin with a steam hammer jolt that lifted him off his feet and laid him out as flat as a flounder.

"A foundry is a great place for starting arguments, even if only a comparatively small number reach the knock-down and drag-out stage. I had a letter recently from a man who wanted me to settle an argument about the proper weight of coke and iron for the bed and charges in two cupolas, one 48 inches and the other 19 inches, serving a jobbing shop. The first is provided with six tuyeres 4 x 16 inches located 22 inches above the bottom. Six 3 x 3-inch tuyeres 14 inches above the bottom supply air to the small cupola. Based on the practice pursued in many foundries I replied that an off-hand answer would read: Bed for the 48-inch cupola, 1500 pounds, successive coke and iron charges, 250 pounds and 2000 pounds, respectively. Bed for the 19-inch cupola, 200 pounds, with succeeding charges of coke and iron, 20 and 150 pounds respectively. However, local conditions may suggest the advisability of revising these figures and for that reason I expanded the reply to present a few of the many features connected with cupola operation which must be taken into consideration.

"So many factors enter into the operation of a cupola that it is impossible to lay down a definite set of figures and claim that maximum results will be secured by adopting them. For example the weight of coke and iron might be proportioned perfectly to work with a certain volume and pressure of blast. Variation in blast will be reflected in melting speed and temperature of iron. Another factor which affects any instruction on cupola charging is that coke shows a variation in weight ranging from 23 to 32 pounds per cubic foot depending on its origin. Unfortunately the heat value of the denser coke is not always higher in proportion to the weight. Therefore, it does not follow that 1 or 10 cubic feet of dense, heavy coke is equal to 1½ or 15 cubic feet of a lighter coke, even though both amounts should show the same weight.

"As a result of a long line of investigation carried on by many men, certain figures regarding the proportion of materials charged in the cupola have been adopted and quoted as typical. Conditions vary to such an extent that even the manufacturer of a standard line of cupolas will not pin himself down to a definite melting speed. He will guarantee the cupola to melt between a minimum and a maximum tonnage per hour *depending on local conditions.* Of course with *every* factor known, he can anticipate the tonnage approximately within a few pounds.

"Under favorable conditions the melting zone in a cupola is located between 24 and 30 inches above the tuyeres. Therefore, regardless of the weight, the cupola bed should extend up to that point at the moment melting commerces. Obviously it must be built a little higher originally to allow for the settling after the cupola is charged and before melting actually commences. The easiest and most practical method for calculating the amount of coke required on the bed is to count the number of forkfuls required to bring the bed 30 inches above the tuyeres, then weigh half a dozen forkfuls to get the average weight of one of these units and then multiply that weight by the number of forkfuls.

WELL, WHAT WOULD YOU DO IN LIKE CASE?

"Under exceptionally favorable conditions iron may be melted in the proportion of 10 pounds of iron to 1 pound of coke, but that is skating fairly close to the danger line and the majority of jobbing foundries use coke and iron that make up the charges in the ratio of 8 or 9 to 1. Also it is well to remember that almost incredible liberties can be taken with a cupola which only is in blast for a short period. Where a cupola has to be kept in blast for several hours the charging must be done carefully and with the varied materials in proper proportion.

"In the event that one is interested in the theory and method of calculating the weight of coke and iron used in a cupola the following figures will be of assistance: The area of the cupola first is found by squaring the diameter either in inches or feet and multiplying the result by 8/10. The proper multiplier is 0.7854, but 8/10 is near enough for all practical purposes and it is a great deal simpler. All one has to do is to multiply the figure by 8 and then point off one decimal place in the result. In the present instance with a 4-foot diameter cupola the formula for finding the cubical content up to a point 30 inches above the tuyeres is:

4 x 4 x 0.8 x 4.33=55.467 cubic feet.

A cubic foot of coke may weigh 23 pounds. It may weigh 32 pounds, or any intermediate weight. Thus the weight of coke required for the bed may be 55.467 x 23 pounds, the minimum, or it may amount to 55.467 x 32 pounds, the maximum. In the first instance it is 1276 pounds. In the second instance it is 1775 pounds. There is a possible variation of 500 pounds, depending on the character of the coke. Comparatively thin splits of coke yield the best and most uniform results. A minimum thickness is 4 inches. The area of the cupola is 12.8 square feet and this multiplied by 0.33-foot (4 inches) shows a cubical content of 4.2 feet. With coke showing an average weight of 28 pounds per cubic foot, the amount required for a theoretical split is 28 x 4.2=117.6 pounds. This must be increased by approximately 50 per cent to meet practical requirements of an uneven surface, or 176 pounds. From eight to ten times this amount represents a suitable iron charge, that is, from 1400 to 1700 pounds. For short heats this amount may be increased to 2000 or 2500 pounds, with a corresponding increase in the amount of coke."

"Arguments," said Bill, "sometimes are based on misconceptions. For example: 'Rastus, your dog seems to be in pain.'

" 'No, suh; he ain't in pain. He's just lazy.'

" 'He must be suffering or he would not howl like that.'

" 'Jes' plum lazy; jes' laziness. He's settin' on a thistle!' "

The Detroit Foundrymen's association will stage a special dinner party at Websterhall, Feb. 16. The party will be known as "Ladies Night" and special entertainment will be provided.

Unsuitable Pattern Equipment Affects Foundry Output

Responsibility for Manufacturing Standards and Policies in Foundry Rests with Management—Operating Experience Aids Salesman

By W. J. Gilmore

ONE of the most important factors in the satisfactory operation of a foundry is suitable pattern equipment. By suitable pattern equipment is meant patterns that are designed to afford maximum efficiency in foundry operation.

Many contributing factors influence the desirability or undesirability of the pattern equipment. For single jobs the loose pattern, of course, is acceptable. For multiple-run jobs a mounted pattern is essential, since loose patterns do not permit the use of modern foundry equipment. The mounting of such patterns should be adapted to the particular molding machine equipment in the foundry in which the castings are to be made.

Flasks, patterns, and core boxes in the foundry may be likened to machine tool equipment and jig equipment in the machine shop. Machine shop standards are so well established that they are taken as a matter of course by the buyer, who, whether he knows it or not, pays for the time required to set up the job and take it down, and the expense incurred in providing special tools and jigs. Standards in the steel foundry industry are not nearly so well established that they are universally accepted by the buyer, but they are just as necessary in the steel foundry as in the machine shop. The industry does not so much need new standards and new policies as they do need respect within the industry for standards and policies that are conceded to be sound.

Customarily, quotations to the customer in addition to naming the price, name the approximate delivery that the customer may expect, and probably specify that suitable pattern equipment shall be furnished by the customer. The customer, except in rare cases, has no conception of what is meant by suitable pattern equipment. Patterns are furnished by him that probably have been used by other foundries, and this fact establishes the suitability of the patterns to the customer's satisfaction. In those cases where the job has not been in a foundry before, the patterns have invariably been made by a jobbing pattern shop in accordance with the customer's order which may have been placed with no consideration given to the various features that influence the final cost of the job through foundry practice.

The average steel foundry salesman rarely sees the customer's pattern on which prices are made by him at the time of making his quotation. He sees the pattern after it is received from the customer and before it is placed in production, almost as infrequently. Unless the pattern is specifically brought to his attention by the shop management, because it is not a suitable pattern from the shop management's point of view, its suitability is probably established by the fact that it has been in use in some other foundry or that it is acceptable to another foundry.

The ill effects of unsuitable pattern equipment are more far-reaching than the average foundryman appreciates. The plea of the customer is frequently that deliveries are unsatisfactory. This is a condition for which pattern equipment alone can be responsible in several ways. The slowing-up of production in the foundry because of unmounted and insufficient patterns is frequently responsible for unsatisfactory deliveries.

At the time the quotation is made and delivery promised, the salesman frequently does not fully inform the customer just exactly what will be required in the way of pattern equipment. The result is that a part of the time required for delivery is taken up by revamping pattern equipment. Delivery consequently is delayed, and the incorrect impression left with the buyer is probably that because of repeated delivery failures the productive capacity does not exceed the demand, and that the steel foundry business must indeed be a profitable one. The result is that a survey of the buyer's needs is made to forecast what can be done by putting in a furnace for making steel castings in one corner of their plant, supplying their own needs and selling the surplus in the open market. The carrying out of such a plan results in economic waste as consumers of castings cannot expect to produce them as efficiently as the steel foundries that specialize in making only steel castings.

Responsibility for manufacturing standards and policies in the foundry rests with the executive management. If the latter permit the sales management or shop management to make concessions from what are recognized as the best standards and policies, their subordinates will, of course, readily acquiesce since they do not fully appreciate how far-reaching are the ill effects of disrespect to the standards and policies that are conceded to be sound.

This matter of suitable pattern equipment, which expressed in another way is foundry standards and policies, is in the same category with steel casting prices. Through unin-

Improvements Needed

CONSUMERS of steel castings frequently frown upon the charge made for suitable pattern equipment. Patterns used by one foundry may be found unsuitable by another. Heads or gates on the equipment may have to be relocated to overcome certain defects. This involves a charge and may lead to a misunderstanding between the foundry and the customer. In the accompanying article pattern expense from the jobbing foundry point of view is discussed by W. J. Gilmore, vice president, Ohio Steel Foundry Co., Lima, O. Observations of policies operative in successful foundries in the industry and the merit of many theories that necessarily must be kept at the forefront are stressed by the author.

telligent treatment or total lack of treatment by the foundry salesmen, it becomes a competitive issue with the result that the foundry and the customer both suffer. The latter suffers unconsciously because due to his lack of knowledge of what is best in foundry practice, he fails to appreciate the merit of good pattern equipment and the numerous benefits that might accrue to him through the use of such equipment.

Too often the steel foundry salesman in the plainest sense is a price maker or a price meeter. He should be a trained foundryman, capable not only of dealing intelligently with purely foundry problems, but also able to sell patterns that are designed to fit the job in the foundry and not patterns that are designed solely with the thought of keeping the initial pattern cost down to the minimum amount.

Benefits that result for the buyer who intelligently co-operates with the progressive foundry in furnishing properly mounted patterns are: Lower cost of pattern up-keep, more uniform castings, and better deliveries. When castings are ordered in quantities from properly mounted patterns, samples are first prepared by the foundry. These samples are cut up to determine the location of any internal defects that may exist and a careful study is made to insure proper location of heads and gates on the pattern equipment to overcome existing defects. Final construction of the pattern is such that the heads and gates cannot be located otherwise by the foundry workers during the manufacturing process. Relocation of the heads and gates might result in new internal defects. The location of heads and gates to insure sound castings means fewer rejections during the machining operation and reduce the consequent loss to the buyer of the machining cost on the rejected castings.

Insures Quick Machining

The uniformity of castings from properly mounted patterns insures faster machining operations because of the uniform fit of the castings in the jigs used for machining them. Such castings also have less excess stock to be removed in the machining operations. Castings from a loose pattern are produced only in a limited quantity each day and their movement through the foundry for the various foundry operations consequently is slowed up. Castings from mounted patterns are produced at a rate that is considerably more rapid than loose pattern production and consequently they move through the foundry in larger lots and the final completion of the order is quickened as a result.

The important thing for foundry operators to recognize is that responsibility for the origin and nature of abuses and disrespect to what we are pleased to call steel foundry standards, is within the industry rather than without the industry. The abuses are recognized and admitted by the leaders, who permit the abuses to continue as competitive factors and with the disposition that in so far as correction is concerned, it is a matter about which individually they can do little or nothing. The shop management of many foundries for years has attempted to establish reform in the existing loose policies, but with only mediocre success. The executive management of foundries in the past has too frequently shown an indisposition to assist its shop management to abolish present loose standards and policies. The shop management's request for improvement of standards invariably has been considered as an alibi or excuse for high costs, poor work, and mediocre results in the foundry, instead of a sincere and intelligent request for the improvement of conditions and policies to the end that the industry as a whole will be really benefitted.

Operating Knowledge Helpful

Recommended improvements dealt with hereafter cannot be made operative unless there is in the sales department an individual who is thoroughly acquainted with foundry practice and fully recognizes the foundry's needs with respect to patterns. This individual must have the ability to read blue prints and visualize therefrom just what will be required in the way of sufficient patterns and core boxes, and what the peculiar requirements of the particular job may be in order to insure maximum efficiency in the foundry. If the sales organization does not have a man possessing these qualifications, the comments and recommendations of the foundry management should carry as much weight as the recommendations of a sales department man such as mentioned.

Ordinarily accepted practice, as it now exists in the steel foundry industry, makes no particular distinction in regard to the various kinds of pattern expense. The tendency seems to do whatever pattern work may be found necessary and charge to the customer as much of the expense as the customer will bear. There should be only two classes of pattern expense, namely: that which is the foundry's expense and that which is properly the customers' expense.

The only pattern expense that should be borne by the foundry is that for repairing patterns and core boxes damaged through foundry abuse, or replacing lost patterns and core boxes and parts. The making of match boards, the changing of gates improperly located on patterns supplied by the customer, the making of heads and gates on patterns not so equipped and supplied by the customer, the rehabilitation of patterns when such work is made necessary because of ordinary wear and tear, and other pattern expense of a like nature, are not true items of foundry expense but are items of expense that are properly chargeable to the customer, in the same manner as the cost of preparatory expense, special tools, and special jigs is borne by the machine shop customer either as a specific charge or by inclusion in the total cost of the work done. Reimbursement for pattern expense should likewise be secured by the foundry through making a specific charge for the work performed or seeing that ample provision for it is included in quoted prices on specific jobs.

The sales department is generally the point of contact between the buyer and the foundry, and upon this department rests the responsibility for advocating the idea of customer's pattern expense as treated here. It is a sound cost policy to make such items of pattern expense a charge against sales expense in those cases where the sales department cannot sell the idea to the customer.

The difference between what may be classed as desirable or undesirable pattern equipment, is now so universally known to intelligent foundrymen that concerted action should be taken to insist upon desirable pattern equipment for every order placed with the foundry; such equipment to be furnished at the customer's expense, thereby eliminating the matter of patterns as a competitive factor.

Supervision Is Recommended

It is desirable that the foundry supervise pattern construction for each job that is to be run in its plant. This makes the foundry responsible for the accuracy of such patterns. Patterns furnished by the customer, for which the foundry is not responsible, should be checked only upon the specific request of the customer and at the customer's expense. The checking of a pattern or a group of patterns, particularly if they are of intricate design, is often much more costly than the foundry management thinks.

Often patterns that may be called

conjunction patterns are furnished the foundry. By changing certain parts on these patterns it is possible to make from them castings of slightly different types or designs. In making the change, possibility of error is increased, the flow of production in the foundry is interrupted, and foundry cost as a whole is usually higher than it should be. This is poor economy. The saving effected in the initial cost of such patterns is in reality multiplied several times, and added to the foundry cost.

Objections Are Cited

Objections sometimes raised by customers against pattern charges are principally the following:

1. To the cost of repairing patterns and core boxes damaged through usage.
2. To the cost of construction of patterns and core boxes necessary to produce quality castings.
3. To the reconstruction of patterns and core boxes originally constructed without consulting the foundry concerning important features of construction.
4. To the recontsruction of patterns that will not draw properly.
5. To the reconstruction of patterns that cannot be fed properly.
6. To the cost of adequate pattern equipment for economical production and to meet required delivery.
7. To the cost of preparing core prints for patterns which are furnished the foundry on which stock cores are specified, and which from a foundry standpoint are not so constructed as to eliminate core shifts, or the shapes of the core prints do not fit standard cores specified.

Full realization of the importance of pattern expense cannot be effected without proper and adequate methods to record all items of expense that are true pattern department costs. Pattern estimates are not always accurate. It is desirable that such estimates be checked by securing competitive bids. In preparing estimates, whether for repairs or for new patterns, necessary information such as name of customer, pattern number, description, customer's order number, blue print number, etc., should be recorded. Requirements should also be fully recorded. These should show the number of patterns required, materials from which the pattern should be made, number of core boxes required and material from which the core boxes should be made, and the number of match boards or match plates required. If the work is performed in the foundry's pattern shop, the estimate should be checked by recording actual material cost and actual labor cost.

Overhead expense must not be overlooked. The more important items entering into overhead expense will be management expense, depreciation of equipment, cost of space occupied by the pattern shop, power, light, heat, a proper charge to provide a return on the investment represented by the pattern shop, taxes, insurance, and any other items of similar nature, a portion of which may be properly charged to the pattern shop. The pattern shop should be operated as a separate unit under the control of the foundry management and not as an auxiliary foundry department.

Briefly, the commonly accepted method of showing the cost of the pattern shop is to charge material and labor to a sub-classification on the cost sheet captioned "Pattern Expense." This is misleading, and the resultant cost per ton shown is roughly only about one-third of the actual cost of the pattern shop as determined when it functions as a separate unit.

With the present cost method just mentioned as being in common use, all items of overhead expense are borne by the entire foundry production, as they are not handled as a charge against the sales value of the output of the pattern shop. By using such a method, the cost of operation of the pattern shop is proportioned against all of the foundry's customers, instead of being properly proportioned to only those customers benefitting from the operation of the pattern shop.

Saving Is Afforded

Experience known to the author indicates savings ranging from $25,000 to $30,000 a year in the pattern department through intelligent treatment of pattern expense. This is no trivial matter. Without exaggerating, it can be said that even the small foundries can unknowingly lose from $50 to $300 a month through concessions on pattern expense. Regardless of the size or the financial worth of the foundry, the matter of pattern expense is a matter of real cost and justifies continuously the closest possibly scrutiny.

In referring to loose patterns it should not be overlooked that there are invariably many other things loose besides the pattern. Molding methods are loose and costs are high, wastage of metal is considerable, hand rapping is required with the frequent result that the casting is larger than it should be, which in turn results in an increased machining cost required to removed the excess metal. If loose, the pattern frequently warps and thereby affects the trueness of the castings which in turn further reacts on the ultimate cost of the product through an enhanced machining cost; or if the parts no not require machining, trouble will be experienced in assembling them because of the castings not being true to dimensions.

Benefits Are Tangible

Some of the benefits of proper equipment which will accrue to the customer are not visionary in any sense, but are tangible benefits which the foundry must identify for the customer. They are: better prices, better and more uniform cost of machining, finishing, and assembling the castings into the finished product, a more regular and uniform flow of production in the foundry with fewer shortages, less special chasing, and quicker completion of orders. A closer adherence to the customer's schedule of production in his own shop is, of course, the result of the uniform flow of foundry production. More uniform castings make fewer emergency shipments to replace imperfect castings.

Theoretically, the customer pays for all items of expense incurred in the foundry although this, of course, is not actually the case. In some instances the ultimate cost is borne by the foundry stockholders, and in other cases, instead of items of expense being properly allocated to the customer for whom the expense is incurred, it is averaged over the entire group of customers. It is more scientific and more equitable for the customer to recognize the fairness of satisfactory pattern equipment, which after the pattern is in production carries assurance of more uniform and dependable deliveries and castings more nearly true and uniform to pattern and of a higher quality.

The thoughts advanced in this paper are not original with the author. They are the result of the author's personal knowledge and observations of the policies operative in those foundries which are outstanding successes in the industry and which have most aggressively pursued the theories advanced. The merit of many of these theories has long been recognized by the active shop management of most foundries, but because of lack of determination on the part of the executive management, the theories have not been kept at the forefront and established as trade policies and customs that are necessary for the well-being of the industry.

The foundries' obligation to their

customers in the broadest sense, is to provide them with castings at the lowest possible ultimate cost, and it is their duty to educate the buyer to the proper method of determining casting cost. This should take in all factors of cost from the initial pattern cost to the cost of the completed casting ready for installation in the finished part in which it may be used. This goal, with which will come the renewed and greater confidence of the buyer, will not be reached until the executive managements apply themselves with determination to the thorough education of the members of their sales departments in order that they in turn may be of the broadest possible service to the customer.

Spins Iron Pipe

(*Concluded from Page* 131)

These shakeout machines are essentially similar to the machines on which the molds are rammed with sand. The main difference is that the bottoms of the molds are left open instead of closed and the jolting causes the sand to fall out of the flask instead of packing together as in the ramming operation. After the sand has been removed, the molds and castings are returned to a horizontal position where an attendant removes the pipe and places it on a skidway as shown in Fig. 9. One end of a long steel bar is inserted in the pipe, the bar is suspended close to this end from a monorail, thus giving the attendant a leverage sufficient to easily take the weight of the pipe and pull it out of the iron mold.

On this last skidway the pipes are examined, brushed slightly at a few points if necessary and a portable grinding wheel is passed through the inside from end to end to remove any slight roughness formed by slag or other foreign material forced to the inside during the pouring operation. One of the claims made for centrifugally cast pipe is that the difference in specific gravity between iron and its impurities causes the iron to settle around the outside while the impurities gravitate to the inside. After the examination the pipes are heated, coated with tar and tested.

Ires Prosser has been appointed southeastern representative of the Botfield Refractories Co., Philadelphia. His headquarters will be at Atlanta, Ga.

Annealing Pot Is Widely Employed Term

Question: I should like to have some information on how annealing pots are made.

Answer: The term annealing pot is applied to many shapes and sizes of castings and without a specific reference to the kind of pot you have in mind it is impossible to present a description. Some of these pots are steel castings varying in weight from 50 pounds up to several tons. A second class is made from gray iron of special analysis and is used for heat treating steel and other small metal parts. A third class and probably the most extensive, is the annealing pot made from hard iron and employed in malleable iron foundries for annealing the castings. Some foundrymen prefer the round pot while other men use a rectangular pot or box exclusively. In either case the casting is a plain frame without either bottom or top. They are stacked and loaded, usually five high on a base plate. The joints are sealed with clay and a cover is luted on the top of each stack in the oven.

Almost without exception malleable foundries make their own annealing pots. One or more floors are set aside for the purpose and a definite number of pots is made every day to replace those worn out in service. When a pot cracks, it admits air and therefore is of no further use. Most of these castings are made in plain open sand molds without a cope. Several large plants make them on jolt ram, rollover, pattern-draw molding machines in special flasks containing a minimum amount of sand. The inside of the flask is *stopped-off* and the walls of the flask, inside and outside are liberally vented. The annealing pots or boxes are poured from the same iron mixture that goes into the malleable castings.

Faked Foundry Facts

An Idler Takes Up the Slack

To Buy Cast Segments

Award of 12,000 tons of cast segments for the Newton creek project on Long Island and 10,000 tons for the Harlem river tunnel, New York, will be made soon. The general contract for the Newton creek project has been awarded to the Mid-Eastern Contracting Co., 236 West 116th street, New York.

Offers Assistantships

The University of Illinois, Urbana, Ill., now maintains fourteen research graduate assistantships in the engineering experiment station to assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering. Two other such assistantships have been established under the patronage of the Illinois Gas association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry. Nominations for these positions, accompanied by assignments to special departments of the engineering experiment station, are made from applications received by the director of the station each year not later than April 1. Additional information may be obtained by addressing the director of the engineering experiment station, University of Illinois.

Describes Plant Changes

Clement A. Hardy, foundry engineer, Chicago, described the work of modernizing the old plant of the Builders Iron Foundry, Providence, R. I., at the February meeting of the New England Foundrymen's association, held in Boston, Feb. 8. Earl T. Bennington, Cleveland Electric Tramrail division, the Cleveland Crane & Engineering Co., Wickliffe, O., spoke on "Materials Handling in the Foundry."

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Centrifugal Castings

Centrifugal Castings for Diesel Engines, by J. E. Hurst, *Foundry Trade Journal*, London, Dec. 15, 1927.

The author describes the manufacture of gray iron castings by the Hurst-Ball centrifugal process and gives the chemical composition for piston rings as total carbon, not more than 3.50 per cent; combined carbon, between 0.45 and 0.80; silicon, 1.80 and 2.50 per cent; manganese, 0.40 and 1.20; sulphur, not more than 0.12 and phosphorus not more than 1.00 per cent. He then gives the physical properties of rings cast by the centrifugal process and their resistance to wear and heat conditions. A description of a centrifugal process using sand molds for the production of complicated piston valve liners also is described. The composition of the metal used for this purpose is given as total carbon, 3.00 per cent; graphite, 2.03 per cent; combined carbon, 0.97 per cent; silicon, 1.31 per cent; manganese, 0.42 per cent; sulphur, 0.11 per cent, and phosphorus, 0.34 per cent.

Aluminum Cast Irons

Aluminum Cast Irons, by Arthur B. Everest, *Foundry Trade Journal*, London, Dec. 22, 1927.

In investigating the effect of aluminum on cast iron, the author made up a number of specimens containing aluminum by adding known quantities of aluminum to American washed iron. The iron was melted in crucibles and when at a temperature of about 1350 degrees Cent. the aluminum was added. After stirring thoroughly the metal was cast into round bars 21 inches long and 1.2 inches in diameter. These bars then were tested for physical properties. Bars were made containing from 1.05 to 7.02 per cent aluminum with approximately 3.35 per cent total carbon; 0.02 to 0.04 per cent silicon; sulphur, 0.04 per cent; phosphorus, 0.03 and manganese, nil.

Preliminary tests showed that an iron containing 3.7 per cent aluminum gave the best results with a transverse modulus of rupture of 33.3 tons per square inch; tensile strength of 17.6 tons per square inch; crushing strength of 57 tons per square inch and brinell hardness number 222. This iron was tested further under elevated temperature and the tests indicate that it is unstable when subjected to high temperatures.

Chromium then was added and it was found that this had a stabilizing effect and exerted a slight hardening action (0.5 per cent chromium) without impairing the mechanical properties of the original alloy. Further specimens then were made containing the usual elements found in cast iron with additions of chromium around 1 per cent, nickel around 0.5 per cent and aluminum around 4 per cent. The iron showed a dense, close-grained fracture; machined freely and gave a good finish. It showed a good resistance to impact and the mean brinell number was 250. Micro examination showed fine curved flakes of graphite in a pearlitic ground mass. Stability of this alloy under elevated temperatures is similar to the previously mentioned aluminum-chrome iron. The author concludes that no special properties are exhibited in the aluminum-iron alloys that cannot be obtained by other simpler and better methods of treating cast iron.

Adds Ferrosilicon

The Addition of Silicon in Cast Iron, by M. Debar. *La Revue de Fonderie Moderne*, Paris, Nov. 25, 1927.

This study was brought about by the difficulties which occurred in manufacturing semisteel following a forced change in the origin of the materials constituting the charge. The change concerned the origin of the scrap, the additions of ferrosilicon and the percentage of steel. It was found that the irregularities were due to the conditions under which the additions of ferrosilicon were made. Ferrosilicon now is obtained under three main categories: containing 75 per cent silicon or more, containing about 45 per cent silicon, or containing from 10 to 25 per cent silicon. The advantages and drawbacks of these various categories are reviewed. The author then describes the tests that were made in varying the conditions under which were made the additions of ferrosilicon. He concludes that great care should be exerted in obtaining a constant composition and in avoiding losses of the ferrosilicon. The use of briquettes of a given composition is recommended.

Tests Fire Brick

Siliceous and Aluminous Fireclay Bricks, by E. Decherf. *La Revue de Fonderie Moderne*, Paris, Nov. 25, 1927.

Refractories should be tested by the user, who sometimes contents himself with a superficial examination and a rough chemical analysis. In addition there should be a fusibility test and an expansion test under constant pressure at given temperatures. These tests are explained briefly, and results are given of chemical analysis, the aspect of the fracture, the fusibility and expansion tests, determined from four bricks of different origin.

Studies Production Costs

Study on Production Costs, by Jules Fivez. *La Revue de Fonderie Moderne*, Paris, Nov. 10, 1927.

The author studies the question of production costs in a jobbing foundry. The costs are classified into two divisions, fixed costs and variable costs. In the first class are included the cost of the ordinary hot iron, the cost of the fuel used in the drying oven for the mold, the cost of the fuel used in the drying oven for cores, and a fixed coefficient pertaining to overhead charges.

Variable costs include the cost of special hot iron, the making of the pattern, the actual cost of making the mold, the cost of materials specially needed for a given casting, the amortization of special equipment, the cost of the loss of sand, core nails, etc., which becomes sufficiently important for large castings, and, where necessary, the cost of transport.

Gives Metal Composition

The Production of Diesel Engine Castings in Pearlitic Cast Iron, in the *Foundry Trade Journal*, London, Dec. 22, 1927.

In a report of the meeting of the Sheffield branch of the Institute of British Foundrymen a discussion of a paper presented by A. J. Richman is given. Included in the discussion is the composition of the cupola charge for diesel engine castings. Mr. Richman stated that the irons used were ordinary irons with domestic scrap and steel scrap. The cupola was charged in the regular way with the steel scrap on the coke followed by the pig and scrap. A pressure of 8 ounces for air with a tuyere area of 1/6 of the cross section of the cupola at the melting zone was maintained. For cylinder liners the following analysis was aimed at: Combined carbon, 0.8 per cent; total carbon, 3.2 per cent; silicon, 0.93 per cent; manganese, 0.8 per cent; sulphur, 0.1 per cent and phosphorus, 0.2 per cent. Material charged was as follows: 200 pounds of steel scrap with 0.3 per cent silicon; 0.06 per cent phosphorus and 0.35 per cent manganese; 200 pounds No. 2 Scotch with the following analysis: Silicon, 2.3 per cent; phosphorus, 0.4 per cent; manganese, 1.0 per cent; 100 pounds No. 4 hematite (high manganese) containing 1.4 per cent silicon; 0.03 per cent phosphorus and 2.1 per cent manganese; 200 pounds of cylinder scrap with the following analysis: Silicon, 0.93 per cent; phosphorus, 0.23 per cent and manganese, 0.6 per cent. The actual analysis from this charge is given as combined carbon, 0.85 per cent; total carbon, 3.19 per cent; silicon, 0.95 per cent; manganese, 0.7 per cent; sulphur, 0.11 per cent; phosphorus, 0.18 per cent.

Prepares Molds

Pattern Molding of Tees, Elbows and Similar Castings, by Jules Fivez. *La Revue de Fonderie Moderne*, Paris, Nov. 10, 1927.

The way of preparing the molds in open sand for such castings and the preparation of the cores is explained. An example is given of a mold prepared for a hollow brace. The article then describes the general principles of loam molding, and chooses for an example the preparation of the mold for two pulleys.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Count Your Blessings

WHAT is more pleasant than to find a five dollar bill tucked away in the watch pocket of last winter's suit? Or, again, does any unexpected gift give more pleasure than a brief note from the tax office advising that last year's assessment was more than ample, enclosed find rebate? Gray iron foundrymen can experience a similar delightful surprise if they are unaware of the store of knowledge accumulating for them through the work of the American Foundrymen's association.

OF COURSE those that are active in the association and those whose accomplishments in research are broadcast through papers and committee reports know of the data thus available. They helped provide the treasures of technical knowledge which to the gray iron industry at large still remains the undiscovered fiver or the last year's tax rebate. Starting with its very inception in Philadelphia, thirty-two years ago, the American Foundrymen's association has delved into this problem of better quality gray iron castings. Whether its findings were involved in elementary discussions of shovels of coke and pigs of iron necessary to aid digestion in the lowly cupola, or whether they embraced the higher whichness of the what of micrographs, eutectics and pearlitics, the sum total of accumulated knowledge has been of tremendous value.

CONSIDER for a moment the *Transactions* of the American Foundrymen's association for the past three years alone. In 1925, a total of 12 major papers, comprising more than 350 pages are devoted to questions of gray iron. These range from the highly technical discussions of metallurgy, through the field of alloy additions to the details of furnace operation; but all have a bearing upon that one most important question of *how* to make better iron castings. Two of the papers, through the prestige of the American Foundrymen's association were brought forth as contributions from European associations and represented the best thought from abroad on the subjects in question. In 1926, a total of 12 papers occupying 320 pages, and in 1927, when an abbreviated schedule of technical sessions was held in Chicago, a list of seven papers with more than 75 pages of vital information on gray iron were offered.

THIS brief summary covers only the formal papers of the annual conventions. It does not take into account the contribution of time, experience and brains brought to bear upon the subject of gray iron castings through the work of different committees. These include the committee on gray iron of the A. F. A., joint committees working with the American Society for Testing Materials and other organizations upon problems of castings manufacture, specifications and details of a technical nature. Nor does this summary of papers give any indication of the great amount of work being done by the A. F. A. on molding, cleaning, refractories, furnace practice, core technique, sand preparation, control and handling which have loomed so large in the convention and committee work of the past few years. All of these features of interest to the broad foundry industry as a whole are brought before the gray iron interests.

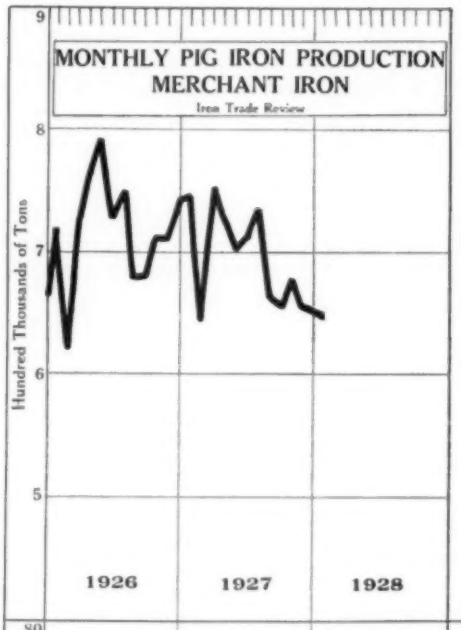
WOULD not a search of the unused pocket, a call upon this vast store of information for gray iron foundrymen be in order? One agency bringing all these sources of data directly home is the recently issued bibliography of cast iron, prepared by the A. F. A. This goes back and searches out all the information published on cast iron since 1858. It includes more than 1500 references, a true gold mine for the sincere seeker after knowledge and a basis to point the way to definite research on this line of manufacture, should research be needed. Further, should not the work of the A. F. A. along these lines be recognized? Contributions to definite lines of research, the investigation of possible improvements in gray iron castings well could be intrusted, with adequate funds provided, to the capable and effective organization which already has done so much.

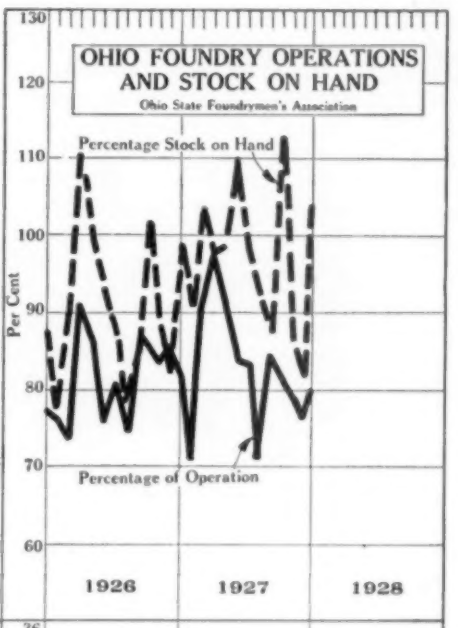
Trade Trends in Tabloid

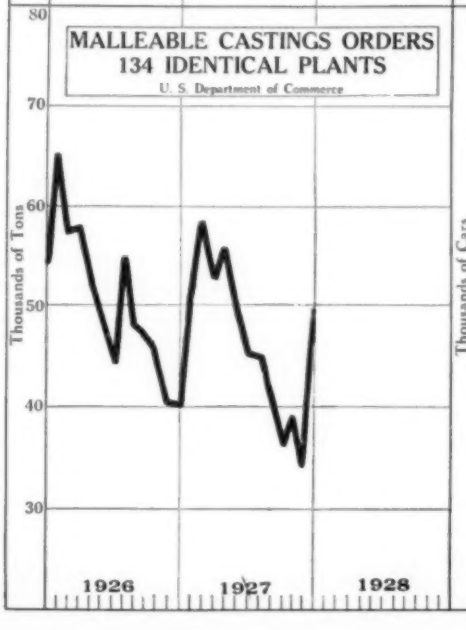
MARKED improvement is noted in many lines of castings manufacture. Steel foundries are benefiting from the amount of railway business which is commencing to filter through, while malleable shops have noted an increase in orders since the first of the year. Automobile manufacturers are confident of good business in 1928. The National Automobile chamber of commerce based its optimistic forecast of 4,500,000 upon attendance at the various shows and the increasing sales which are noted. Implement sales were 5 per cent ahead of the previous year during 1927 with exports climbing in both farm machinery and tractors. Iron and steel production has started upward, particularly in the Pittsburgh, Cleveland and Valley regions. This is reflected directly in foundry operations in these sections. Blast furnace figures, compiled by the *Iron Trade Review* show that the total production of pig iron for January was 2,855,515 long tons, compared with 2,698,208 tons for December. Merchant iron output for the past month was 649,654 tons compared with 660,616 tons for the last month of 1927. The average monthly prices for nonferrous metals, according to New York quotations in the *Daily Metal Trade* follow: Casting copper, 13.853c; electrolytic copper, 14.112c; Straits tin, 55.616c; Lead, 6.50c; antimony, 10.98c; aluminum, 23.90c.

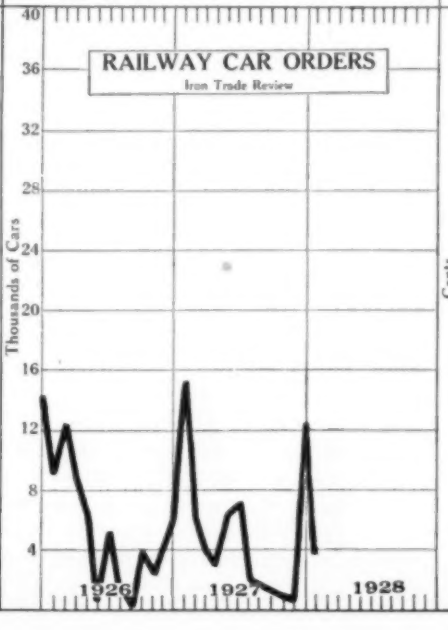
RAW MATERIAL PRICES
Feb. 4, 1928

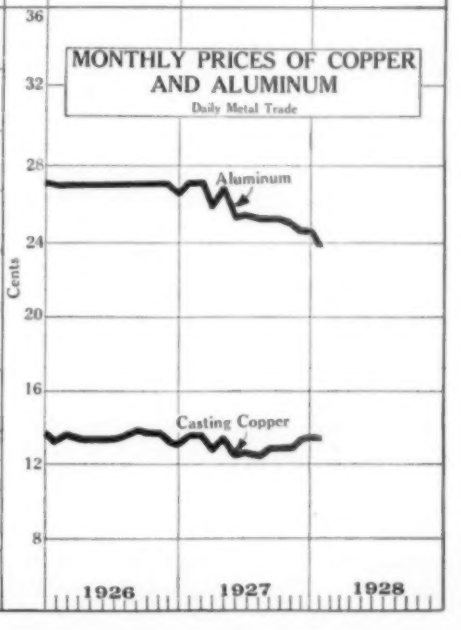
Iron	
No. 2 foundry, Valley	$17.25
No. 2 southern, Birmingham	16.00
No. 2 foundry, Chicago	18.50
No. 2 foundry, Philadelphia	20.26
No. 2 foundry, Buffalo	17.00
Basic, Valley	17.50
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	18.50
Malleable, Buffalo	17.50
Coke	
Connellsville foundry coke	$3.75 to 4.25
Wise county foundry coke	4.00 to 5.00
Scrap	
Heavy melting steel, Valley	$15.00 to 15.50
Heavy melting steel, Pitts	15.25 to 15.75
Heavymelting steel, Chicago	12.50 to 13.00
Stove plate, Chicago	12.00 to 12.50
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	14.00 to 14.50
No. 1 cast, Buffalo	11.50 to 12.00
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	14.25 to 14.75
Railroad malleable, Chicago	13.00 to 13.50
Agricultural Mal., Chicago	11.75 to 12.25
Malleable, Buffalo	14.50 to 15.00
Railroad malleable, Pitts	14.50 to 15.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.75 to 13.87½
Electro copper, producers	14.12½
Straits tin	54.37½
Lead, New York	6.45 to 6.50
Antimony, New York	11.12½
Nickel, electro	37.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	17.00 to 18.00
Zinc, East St. Louis, Ill	5.62½ to 5.65











Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

MYRON L. DOELMAN has been made general plant superintendent of the Framingham, Mass., plant of the National Radiator Corp., succeeding Charles A. Roberts, who recently resigned. Mr. Doelman was connected with the American Radiator Co. for a number of years in the capacity of foundry foreman and general foundry foreman. He also was superintendent and plant manager of the Union Radiator Co., Johnstown, Pa., for several years.

L. E. Thomas, president, Reading Iron Co., Reading, Pa. has sailed on an extended Mediterranean cruise.

Henry H. Peck has been appointed New York district sales manager for the Eagan-Johnson Steel & Iron Co., Crum Lynne, Pa., with offices at 114 Liberty St., New York.

F. Stiehl has been made general superintendent of the Meadville Malleable Iron Co., Meadville, Pa. Mr. Stiehl formerly was superintendent of the Peoria Malleable Steel Castings Co., Peoria, Ill.

David Adams has been made foundry superintendent of the W. A. Riddell Co., Bucyrus, O. Mr. Adams formerly was connected with the National Malleable & Steel Castings Co., Sharon, Pa.

J. G. Kettle, manager of the Geneva, N. Y. plant of the United States Radiator Corp. has resigned to devote his time to personal interests. He has been associated with the radiator corporation 22 years. C. H. Gable, general superintendent, will take over the duties of Mr. Kettle.

Walter T. Noble, superintendent, the E. D. Jones Sons & Co., Pittsfield, Mass., has resigned. Mr. Noble has been connected with that company since 1872 and has been superintendent since 1890. Harry M. White will succeed him as superintendent.

Horace A. Frommelt has been made supervisor of apprentices for all plants of the American Steel Foundries, Wrigley building, Chicago. Mr. Frommelt was graduated from Champion college, Prairie du Chien, Wis., and received his master degree in electrical engineering at Iowa State colledge, Ames, Iowa. He then was connected with the Falk Corp., Milwaukee for eight years, two years as consultant to the apprentice training department, two years as assistant works' manager, and four years as apprentice superintendent. In 1926 he resigned his position with that company to become associated with the International Correspondence school, Scranton, Pa., as consultant in the apprentice training division.

Emile Ramas recently has been made an officer in the Order of the Legion of Honor of France. Mr. Ramas is honorary president of the Association Technique de Fonderie de Paris and a director of the French Griffin company.

Dr. Richard Moldenke, addressed the Philadelphia Foundrymen's association at the Manufacturers club Saturday evening, Feb. 11. He gave a resume of his observations regarding foundry practice in Germany and Sweden.

Fire Destroys Mail

A disastrous fire which severely damaged the incoming branch, post-office building in Cleveland, Friday night, Jan. 27, destroyed some mail and probably prevented many letters addressed to THE FOUNDRY *from reaching this office. Anyone who wrote to* THE FOUNDRY *on or about that date or who has not received an answer to correspondence sent during that week will confer a favor by duplicating this mail matter and again addressing this publication.*

To Build Russian Plant

A contract has been signed in Moscow between the metal trust of the Russian soviet government and Frank D. Chase Inc., Chicago, for the building of a new gray iron foundry at Podolsky, a suburb of Moscow. The new foundry, which will have a yearly capacity of 150,000 tons, is to be a unit of a sewing machine works to be operated by the soviet government on the site of the former Russian plant of the Singer Sewing Machine Co.

Preliminary arrangements for the contract were made in this country by C. R. Cady, engineering representative of Frank D. Chase Inc. Mr. Cady now is in Moscow, where he has completed the final details of the contract. Mr. Cady will return to Chicago and will assist in purchasing foundry equipment for the Russian concern, after which he will return to Moscow to supervise the installation of the equipment and help get the foundry into production. A complete conveying system will be a part of the foundry unit.

Change Iron Meeting To Pittsburgh

The Philadelphia Foundrymen's association in co-operation with western gray iron interests has decided to transfer the meeting of gray iron foundrymen, originally called for Philadelphia on March 13, to Pittsburgh. The Pittsburgh meeting, which will be devoted to a discussion of the problems now facing the gray iron industry, will be held on March 13. Joint invitations to the Pittsburgh meeting will be sent out about the middle of February.

Equipment Manufacturers in Plane Crash

Walter F. Piper, Beardsley & Piper Co., Chicago, was severely injured in an airplane crash at Sharon, Pa., Feb. 2. The plane, which was piloted by Elmer O. Beardsley, fell on the grounds of the Sharon Country club shortly after taking off. Mr. Piper suffered a fractured skull and fractures of both legs. Mr. Beardsley escaped with minor injuries. The two men were en route to Chicago after inspecting recently-installed machinery in the plant of the Valley Mold & Iron Co.'s plant at Sharpsville, Pa.

Describes Trucks

The Society for Electrical Development, New York, in co-operation with twenty manufacturers of electrical industrial trucks and tractors, storage batteries and accessories, has published a 96 page handbook dealing with the efficiency and economy of the electric truck and tractor in industry. Operating processes and the particular type of truck suited to individual jobs in sixteen major industries are described. An outline of operating costs with that type of equipment also is given. This book which is entitled "Profitable Application of Industrial Trucks and Trac-

tors In Industry" is based on a survey of 200 typical plant operations made by a member of the survey committee of the American Society of Mechanical Engineers. H. J. Payne edited the publication.

Talks on Safety

Ralph H. West, West Steel Casting Co., Cleveland, addressed the members of the Cleveland district group of the Ohio State Foundrymen's association at a meeting held in Cleveland, Tuesday evening, Feb. 7. The subject of Mr. West's talk was "Is Safety Work in the Foundry Profitable?" In the first part of his talk, Mr. West discussed the various causes of accidents in the foundry and pointed to the methods which must be followed in carrying on safety work. He stated that all safety efforts must originate with the management and the work must be carried on through such key men as the superintendents and foremen. The superintendent must lead the way and must take every safety precaution which the management expects the men to make. Success of the safety movement in any plant depends largely on the foremen, since they must carry out the orders of the management.

Mr. West spoke of the great cost of accidents and the amount of money which must be expended in replacing a man in the shop. He pointed out that it costs the state commissions, and that in turn means industry, in the neighborhood of $2500 for the loss of a foot, $3000 for the loss of a hand, and $2000 for the loss of an eye. Each major accident costs the industry the interest on $50,000 at 6 per cent. This is the equivalent of the use of a $50,000 tool for one year. If a plant expected to make the purchase of equipment costing that amount of money, weeks of study would precede the expenditure. Yet many plants are doing very little to further the safety movement.

In conclusion, Mr. West pointed to the valuable work that has been done by the National Safety council in furthering safety in industry. In his estimation, safety work in the foundry pays, and pays well.

Films Grinding Machines

"The Thirtieth Part of a Hair" is the title given to a new motion picture film, recently produced by Norton Co., Worcester, Mass. This film is a picture story of the accuracy of manufacturing methods in grinding machine production. Several scenes show operations which represent the highest degree of mechanical excellence in machine construction. The film opens with a picture of the dirigible LOS ANGELES in full flight; shows Major Segrave traveling 203.8 miles an hour in his Sunbeam racer, presents a most interesting comparison of the automobile engine of today and yesterday, shows the operation of several machines made possible by grinding and then goes into the construction of the grinding machine. The film is two reels long and may be booked, without cost, through the publicity department of the Norton Co., at Worcester, Mass.

Supply Illustrations

Through an oversight proper credit was not given to the John Williams Co., Inc., New York, for supplying the illustrations used in the article "Foundryman's Genius Builds Architect's Vision in Bronze" which appeared in the January 15 issue of THE FOUNDRY on page 61. These illustrations were supplied through the kindness of Alexander H. Burgess, president, and Wm. Donald Mitchell, vice president of that company.

Companies Are Merged

The Andrews-Bradshaw Co., Pittsburgh, recently has been merged with the Blaw-Knox Co., Pittsburgh. The Andrews-Bradshaw Co. makes a device for cleaning steam, gas, air and vapor. No change in the organization of the Andrews-Bradshaw Co. is contemplated, with the exception that the products of that company will be manufactured in the main plant of the Blaw-Knox Co., Blawnox, Pa.

To Visit Europe

William H. Nicholls, president, Wm. H. Nicholls Co., Inc., sailed for Europe February 11 on the S. S. LEVIATHAN. He will visit England, France, Germany, Belgium, Switzerland, Italy and Czechoslovakia to make arrangements for the manufacture and sale of molding machines. The Wm. H. Nicholls Co. report a highly satisfactory volume of business. For the past four months the Richmond Hill plant of that company has been operating both day and night shifts.

Establishes Warehouse

The Norton Co., Worcester, Mass., has opened a new warehouse at 5805 Lincoln avenue, Detroit. Through an error, it was stated in the Feb. 1 issue, that this warehouse was opened in Worcester, Mass. The new distributing building is a 3-story structure, 100x124 feet. More than half of the 50,000 square feet of floor space in the building will be used to store grinding wheels and other abrasive products.

St. Louis Supply Firms Form Merger

M. A. Bell & Co. has been formed to take over the foundry supply business in the St. Louis territory formerly handled in this district by the S. Obermayer Co., E. J. Woodison Co. and the Independent Foundry Supply Co., these three interests participating in the ownership of the new organization. The headquarters of M. A. Bell & Co. are at 217 Lombard street, St. Louis. M. A. Bell, formerly with the Independent Foundry Supply Co., St. Louis, is in charge of the new business. It is expected that this consolidation will considerably improve the facilities available to users of foundry supplies in the territory tributary to St. Louis.

Sails on World Trip

Ira Bixler, president of the Enterprise Sand Co., Pittsburgh, producer of foundry molding sands, etc., and president of the Bixler Coal & Coke Co., seller of foundry and other coke, coal, etc., sailed early in January on the Cunard liner FRANCONIA from New York on a tour around the world. When he returns to his office May 1, he will have visited more than 500 points of interest in Europe, Asia, Africa and elsewhere. He expects to arrive in Los Angeles, April 7.

Equipment Orders Gain

The index of gross orders for foundry equipment in December was 106.8 as compared with 95.8 in November, according to a report of the Foundry Equipment Manufacturers' association. The index of shipments was 110.4 in December against 97.2 in November. Unfilled orders declined from 105.8 in November to 103.5 in December. The base is the average monthly shipments for the years 1922-23-24. Comparisons of monthly orders follow:

	1924	1925	1926	1927
Jan.	141.8	104.2	168.2	180.4
Feb.	121.0	108.8	154.9	198.0
March	121.9	159.3	157.3	131.1
April	146.8	124.3	113.2	130.0
May	108.4	113.3	128.5	134.8
June	96.4	110.5	133.5	138.4
July	62.8	117.0	127.3	89.9
Aug.	77.5	190.0	141.2	106.4
Sept.	66.0	84.2	114.0	80.4
Oct.	85.5	149.5	140.5	98.0
Nov.	91.4	180.3	133.4	95.8
Dec.	137.8	140.1	181.0	106.8

Base: Average monthly shipments for 1922-23-24.

The Landis Machine Co., Waynesboro, Pa., has purchased a sand mixer and bucket loader from the National Engineering Co., Chicago, through Whitehead Bros. Co.

Obituary

R. F. Devine, Sr., aged 67, president of the Erie Forge Co. and the Erie Forge & Steel Co., Erie, Pa., died Jan. 3.

Charles J. Lilienthal, director of the Bishop & Babcock Mfg. Co., Cleveland, manufacturer of cabinets, faucets, etc., died recently in Los Angeles.

Edward Diehl Wittman, 32, president of the Atlas Brass Foundry Co., Columbus, O., died Jan. 8.

Everett J. Neville, formerly vice president and general manager of the C. O. Bartlett & Snow Co., Cleveland, died recently in Oakland, Calif.

Julius Jonson, for 20 years president of the former Jonson Foundry & Machine Co., 118th street and Harlem river, New York, died recently at his home.

R. H. Metcalf, financier for the International Molders union and former secretary of the Cleveland Molders union, died recently in Cincinnati.

Charles Leon Snow, until his retirement last year, treasurer of the Air Reduction Co. Inc., New York, died of heart disease at his home recently.

George C. Horst, assistant to the vice president of the Jeffrey Mfg. Co., Columbus, O., died at his home Dec. 30. Mr. Horst had been connected with the Jeffrey company for 40 years.

Dennis J. Crowley, general superintendent of the Meadville Malleable Iron Co., Meadville, Pa., died recently at his home at Rochester, N. Y., at the age of 67. He entered the iron industry at Cleveland when he was 20. Fifteen years ago he moved from Buffalo to Rochester.

Daniel Kennedy, president of the Kennedy Valve Mfg. Co., Elmira, N. Y., died at Hot Springs, Ark., Jan. 14. Mr. Kennedy founded the valve company in New York in 1877. In 1890 the plant was transferred to Coxsackie, N. Y. and need for further expansion caused its removal to Elmira in 1907.

William J. Henry, president of the Crouse & Pope Foundry Corp. and the Henry Forge & Tool Co., Auburn, N. Y., and also president of the Oswego Tool Co., Oswego, N. Y., died recently in a hospital at Auburn following an operation. Mr. Henry was active in civic affairs. He was the past president of the chamber of commerce and the Auburn Rotary club and was president of the Cayuga County laboratory, and the Mercy hospital and chairman of the Auburn Industrial board.

George W. Traut, vice president of the North & Judd Mfg. Co., New Britain, Conn., died recently at the age of 58. In 1889 he entered the firm of Traut & Hine, with which his father was associated, and of which he became treasurer and later president. When that firm merged with the North & Judd company, he was made vice president of the larger company.

Fred Blundell, plant manager of the Ninety-fourth street plant of the Forest City Foundry & Mfg. Co., Cleveland, died Jan. 30. For about 35 years, Mr. Blundell was connected with the Taylor & Boggis Foundry Co., Cleveland. Four years ago he left that company to join the Forest City company.

Thomas A. Jones, 64, vice president of the W. A. Jones Foundry & Machine Co., Chicago, died Jan. 19 at his home in River Forest, Ill. Mr. Jones was born in Susquehanna county, Pennsylvania, and went to Chicago during the World's fair where he became associated with the Jones foundry. Later he became its managing head.

E. M. Drummond, president of the Drummond Mfg. Co., Louisville, Ky., long identified with the foundry, boiler and machinery manufacturing industry, died at his home in that city Sunday, January 22nd. Mr. Drummond was one of the organizers of the American Foundrymen's association through his attendance at the convention in Philadelphia in 1896.

Samuel Howard Bell, secretary of the Warren Foundry & Pipe Corp., 11 Broadway, New York, and assistant secretary of the Warren Foundry & Pipe Co., Wharton, N. J., died recently at Wharton. For a number of years he was with the Johnstown Iron Works, Johnstown, Pa., and later with the Ingersoll-Rand Co., New York. Before the Replogle Steel Co. was taken over last year by the Warren Foundry & Pipe Corp. he was secretary of the former company.

Prof. B. W. Benedict, manager of shop laboratories, University of Illinois, Urbana, Ill., died recently. Professor Benedict was born in Buda, Idaho, Dec. 19, 1876 and had been in charge of the laboratories since 1912. During the war he served as a captain in the United States army. He was a member of the American Society of Mechanical Engineers and the American Society for the Promotion of Engineering Education and was the author of many technical articles. He also served on several standardization committees of the American Foundrymen's association.

Charles C. Roundy, aged 65, president of the Sargent, Osgood & Roundy Co., Randolph, Vt., died at his home in Worcester, Mass., Jan. 20. Mr. Roundy was a native of Springfield, Vt. and for a number of years was associated with the Richardson Mfg. Co., Springfield. In 1903 he organized the Sargent, Osgood & Roundy Co. at Randolph. He returned to Worcester in 1911 and became sales manager of the Richardson Mfg. Co., remaining there until 1922 when he returned to Randolph and became president of the business which he had organized there.

J. A. Hellstrom, president of the Richard Mfg. Co., Bloomsburg, Pa., and chief engineer of the Wheeling Mold & Foundry Co., Wheeling, W. Va., died recently. He was a graduate of the University of Stockholm, Stockholm, Sweden, and was employed by the Baldwin Locomotive Works upon his arrival in the United States. Later he became associated with the Cambria Iron Co., DuBoise Iron Works and the Jones & Laughlin Steel Corp. He became chief engineer of the Wheeling company in 1905 and for the past ten years was president and general manager of the Richard company.

William Schwanhausser, chief engineer of the Worthington Pump & Machinery Corp., died Jan. 15 at Peck Memorial hospital, Brooklyn, after an illness of six months. Mr. Schwanhausser was born in Bavaria 73 years ago, graduating as mechanical engineer from the Polytechnic Institute at Mittweida, Saxony, in 1874. After coming to this country he was employed by the Yonkers firm of Osterheld & Eichmeyer, assisting in the development of engines, pumps, typewriters, electric motors and agricultural reapers and mowers. Later, as assistant general superintendent of the Otis Elevator Co., for eight years, he worked on the improvement of the hydraulic elevator. In 1885 Mr. Schwanhausser took charge of the Worthington Hydraulic Works, then in Brooklyn.

United States federal specifications board, Washington, recently has published proposed specifications for copper-nickel alloy castings; copper-nickel alloy rods, bars, shapes, plates, sheets and strips, and cast iron soil pipe and fittings, coated and uncoated. The federal specifications board will be glad to receive any comments or suggestions on or before Feb. 29.

Buys Tiffany's Foundry

The General Bronze Corp., New York, recently formed through a merger of the John Polachek Bronze & Iron Co. and the Renaissance Bronze & Iron Works, has completed negotiations for the purchase of the bronze and iron works of the Tiffany Studios, including the material, equipment, work and contracts on hand and goodwill. No new financing will be required. The plant of the Tiffancy Studios, Corona, L. I., covers two and one-half acres and employs about 350 workers. It has specialized in the manufacture of architectural bronze and iron, lighting fixtures and appliances, and general metal work that was sold under the Tiffany trade name. Prior to founding his own company in 1910, John Polachek, who is president of the new General Bronze Corp., was in charge of the Tiffany plant.

Designs Large Grinder

Kling Bros. Engineering Works, 1300 North Kostner avenue, Chicago, recently has introduced a new high-speed heavy duty grinder. The machine is designed to take unusually heavy cuts and at the same time maintain a good commercial accuracy. The grinder is 59 inches long, 49 inches high and 38 inches wide and weighs approximately 3700 pounds. The machine is driven by a standard 15-horsepower ball bearing motor running at 1800 revolutions per minute. The grinding wheels required are 24 inches in diameter and run at a constant peripheral speed of 8500 feet per minute.

The high carbon steel wheel shaft, 4 15/16 inches in diameter, is accurately machined and fully supported by heavy ball bearings. The bearings are located near the wheels to prevent overhang and eliminate vibration and friction. Three pulleys, mounted on the wheel shaft, and the motor mounted on a movable bed, permit adjustment to give a constant peripheral speed.

Heavy steel guards, equipped with adjustable spark protectors, are mounted over each wheel. Manganese steel rests are mounted on the guards to permit the work to be handled near the grinding surface. Rests and guards are controlled by a single adjustment. All moving parts are completely enclosed as may be noted in the accompanying illustration.

Sells Sand Machines

The Royer Foundry & Machine Co., Kingston, Pa., has sold sand separators and blenders to the Bridgeport Malleable Iron Works, Bridgeport, Conn.; the J. I. Case Threshing Machine Co., Racine, Wis.; the Chambers Mfg. Co., Shelbyville, Ind.; the Thomas Devlin Mfg. Co., Burlington, N. J.; the Duriorn Co. Inc., Dayton, O.; the Landis Machine Co., Waynesboro, Pa.; the Magnus Co. Inc., Los Angeles; the Magnus Co. Inc., Chicago; the Magnus Co. Inc., St. Louis; the Modern Foundry Co., Cincinnati; the U. S. Aluminum Co., Cleveland; and Whitehead & Kales Co., River Rouge, Mich.

Describes Sandblasting

The American Foundry Equipment Co., Mishawaka, Ind., recently has issued an interesting book describing the various features of a new sandblast room manufactured by that company. The method of returning the spent abrasive, the single valve for controlling the work, the method of ventilating, the clear visibility provided, and the gravity feed for the abrasive are among the features described. A phantom drawing shows the construction of the unit.

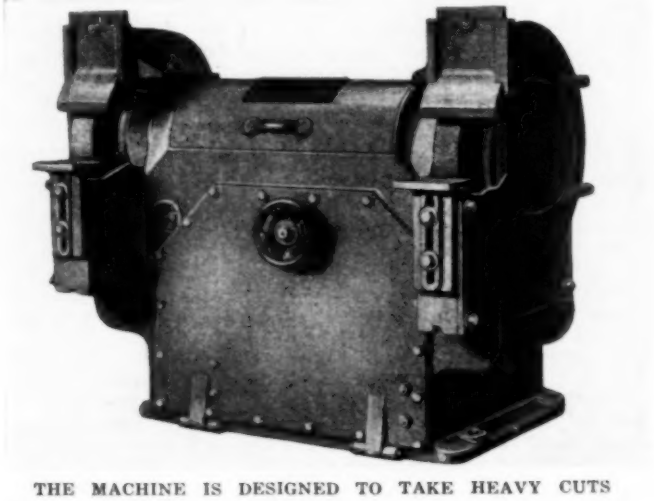
Conducts Investigation

Recently the engineering experiment station, Iowa State college, Ames, Iowa, published a bulletin entitled "The Metastable Nature of Iron Carbide," by Anson Hays. The author concludes that the experimental data show that iron carbide in the alloys used is metastable at temperatures of 850 degrees Cent. and above in the presence of a slightly oxidizing mixture of carbon monoxide and carbon dioxide under a pressure of 5 atmospheres. This bulletin is No. 83 and may be obtained by addressing the experiment station of the college.

Builds Electric Tractor

The Yale & Towne Mfg. Co., Stamford, Conn., recently has introduced a new heavy type electric-driven tractor. This machine is capable of an ultimate draw bar pull in excess of 4000 pounds, depending upon road surface conditions, and will operate a continuous draw bar pull of 1000 pounds without danger of overheating. The machine is driven from all four wheels and is equipped with four wheel brakes. The brakes operate through differentials so that they equalize properly regardless of the conditions of the lining.

Steering is accomplished through a lever handle arranged so that it may be folded out of the way of the driver. The steering knuckles on all four driving wheels are equipped with a ball flush bearing which greatly lightens the burden of steering. Two standardized units connected in parallel at the controller are used to drive the truck. The employment of standard units in this heavy duty tractor permits maximum interchangeability in the hands of the customer. The machine regularly is furnished with a 48-volt motor, and a 23 to 1 gear ratio. An exceptionally heavy frame is used.



THE MACHINE IS DESIGNED TO TAKE HEAVY CUTS

THE TRACTOR IS DRIVEN FROM FOUR WHEELS AND IS EQUIPPED WITH FOUR-WHEEL BRAKES

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Bedford Foundry & Machine Co., Bedford, Ind., has increased its capital stock from $175,000 of common stock to $300,000.

Andy Pattern & Foundry Co., 2222 West Monroe street, Chicago, was sold at auction Jan. 30.

Klotz Machine Co., Sandusky, O., suffered plant damage by fire to the extent of several thousand dollars on Jan. 26.

Keeley Stove Co., Columbia, Pa., resumed operations Jan. 25, after being idle for over a month.

Detroit Stoker Co., General Motors building, Detroit, plans to build a 2-story addition at Monroe, Mich.

National Sanitary Co.'s plant, Salem, O., was damaged by a fire Jan. 29, starting in the company's enameling plant.

West Virginia Malleable Iron Co., Point Pleasant, W. Va., suffered fire damage to its office Jan. 21.

Otis-Sawyer Boiler & Foundry Co., Oswego, N. Y., maker of small heating boilers, suffered damage to its plant in a recent fire.

Rockledge Foundry Corp., New York, has been incorporated with $5000 capital to manufacture bronze and iron products by S. A. Syme, Mount Vernon, attorney.

Detroit Gray Iron Foundry, Iron and Wight streets, Detroit, is inquiring for foundry equipment, etc., for its contemplated 1-story foundry, 115 x 130 feet.

Central Foundry Co., Marshalltown, Ia., will not rebuild its plant recently damaged by fire. The company expects to liquidate its affairs in the near future and discontinue business.

Erie Foundry Co., Erie, Pa., has moved its Detroit office to 335 Curtis building, West Grand boulevard and Hamilton avenue. R. B. McDonald, representative for Michigan, continues in charge.

Atlas Pattern & Mfg. Co., Detroit, has been incorporated with $10,000 capital to manufacture wood and metal patterns, dies and models by William Landless, 3975 Montclair avenue.

Richard Zeley Foundry Co., 178 Collins street, Joliet, Ill., has been incorporated with $20,000 capital to do a general foundry and machine shop business with Barr & Barr, Morris building, Joliet, correspondents.

Keystone Aluminum Die Casting Co., Philadelphia, has been incorporated with $50,000 capital to manufacture and deal in die castings and other metal products by Frank Brown, 6370 Church road.

Maynard Electric Steel Casting Co., Milwaukee, Kilburn road and North-Western tracks, has increased capital from $210,000 to $500,000 and will double its capacity of 1000 tons of castings per month.

Superior Foundry Corp., Grand Rapids, Mich., Wernette & McCarthy, 441 Houseman building, architects, is inquiring for iron foundry equipment including cranes, cupola, etc., for its contemplated 1-story foundry, 80 x 175 feet. (Noted Feb. 1.)

Oregon Brass Works, Linnton road, Portland, Oreg., has awarded the contract for the second unit 30 x 70 feet, of its new plant to Wegman & Son, Board of Trade building. It is expected that a third unit will be built sometime this year.

Josam Mfg. Co. and Josam Products Foundry Co., Cleveland, and with a foundry at Michigan City, Ind., have elected the following officers for both organizations: J. Hirshstein, president; E. M. McLundie, vice president; R. C. Koblitz, treasurer; M. B. Koblitz, secretary. M. J. Hirshstein and the officers from the board of directors.

Akron Foundry Co., Akron, N. Y., has been organized to take over the business operated for many years by Theodore Thayer and his son, Asa T. Thayer. Principal stockholders are Asa T. Thayer, Henry L. Avery and Grover Meahl.

Armstrong Furnace Co., London, O., M. B. Armstrong, president and general manager, is inquiring for foundry equipment for the manufacture of hot air furnaces. The company recently was organized with $750,000 capital.

The plant of Haines, Jones & Cadbury, Washington street, Norristown, Pa., has been purchased by the United Fipe & Supply Co. which plans extensive improvements and additions. Following the completion of these, the United Pipe company plans to move to the newly acquired plant.

Broadway Iron Foundry Co., and Barbour Stockwell Co., Cambridge, Mass., have consolidated. The equipment of the gray iron foundry of the former has been removed to the plant of the later at 205 Broadway. The machine shop and brass foundry will be moved later.

Property of the Acme Brass & Metal Works at Waupaca, Wis., has been purchased by J. E. Fuller and associates of Rockford, Ill., who will make extensive alterations and install considerable new equipment, including a complete gray iron casting unit as an addition to the brass furnaces. The nickeling shop also will be rebuilt and re-equipped.

The Crucible Steel Castings Co., Milwaukee, which within the past two years has established a new plant on a new site at Fifteenth and Oklahoma avenues, has sold its former plant at 612 Clinton street, to the Mertes Machinery Co., which will make extensive alterations and re-equip it for the manufacture and distribution of contractors' equipment and machinery.

Chapman Valve Mfg. Co., Springfield, Mass., recently re-elected officers as follows: Adolph W. Gilbert, president; Edward A. Cater, vice president; John J. Duggan, secretary-treasurer; Edwin C. Gilbert, general manager; Phillip M. Tucker, Frank A. Woods, Mr. Carter, George M. Holbrook, Emerson G. Gaylord, C. C. McElwain and A. W. and E. C. Gilbert, directors.

Athens Stove Co., Athens, Tenn., recently raised its capital to $150,000. The following directors were elected: J. G. Fisher, G. F. Lockmiller, A. E. Walthall, C. L. Williams, C. A. Beard, E. L. Willson, E. G. Fisher, R. J. Fisher, Sr., and W. R. Cooke. The officers of the company were all re-elected: R. J. Fisher, Sr., president; A. E. Walthall, vice president; G. L. Williams, secretary and treasurer and general manager.

American Metal Products Co., Thirty-fourth and Burnham streets, Milwaukee, is building a foundry addition 80 x 160 feet, doubling its capacity. In addition, it is purchasing two electric furnaces and installing a 5-ton crane and a modern core oven. A building 80 x 120 feet is being built also to house its rolling mill. C. J. Zaiser is president of the company.

A steel foundry for the utilization of waste materials is to be erected by the United Verde Copper Co. at Jerome, Ariz., at an estimated cost of $100,000. The plant will consist of a steel furnace, brass furnace and an annealing furnace. Castings will be made at the new plant and in addition much steel material that has been purchased will be made in the local furnace.

Mattoon Engine Works, Mattoon, Ill., has been organized and has bought the assets of the Chuse Engine & Mfg. Co., of that city, which was sold by court order, sale being confirmed by the court Jan. 21. Directors of the new company are: Fred Grant, vice president, National Bank of Mattoon; W. T. Osborne, president, Central Trust & Savings Bank; J. Stanley Weis, cashier, National Bank of Mattoon; Emery Olmsted, and R. A. Gabbert, Mattoon. R. A. Gabbert has been elected president, W. T. Osborne vice president, and J. Stanley Weis secretary and treasurer. J. R. Brumleve continues as sales manager after 17 years' service. Fred D. Dahling, general superintendent, who has been with the company 27 years, remains in that capacity with practically the same organization as before the sale. The company has complete patterns and drawings of all installations of Chuse engines and will render the same service as the former company.

New Trade Publications

LIFTING DEVICES—A variety of lifting devices for industrial use is described in a bulletin by Hubert Morris Inc., Buffalo. They include chain-blocks and trolleys, jib cranes, runways, hand cranes, slings and grabs and ash hoists. The bulletin is illustrated.

STEEL PLATFORMS—Its corrugated pressed steel platform is featured in a bulletin by the Youngstown Pressed Steel Co., Youngstown, O. The platforms are used for trucking materials about the plant. A variety of accessories enlarges their use for a large number of purposes. Illustrations indicate these uses.

BLOWERS AND COMPRESSORS—A catalog of its centrifugal blowers and compressors has been issued by the Elliott Co., Pittsburgh. It is illustrated from photographs of various types of this equipment and its component parts, by working installations, charts showing curves, and tables of data.

MATERIAL HANDLING—Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., has issued a bulletin on economical moving of ceramic and similar products in the plant. Larger loads with fewer men form the basis for this bulletin. It is illustrated.

MOLDING MACHINES—Universal System of Machine Molding and Machinery Co. Ltd., London, England, has published a 68-page catalog describing its molding machines and foundry appliances. Features of construction are presented and applications of the various machines given. Dimensions of the machines also are given. The machines are designed for hydraulic or hand operation, and are of the squeezer, jolt, roll-over or combination types.

HARDNESS INDICATOR—A device manufactured by the Shore Instrument & Mfg. Co., Jamaica, N. Y., is the subject of a current bulletin. It is a static mechanical pressure machine acting on a small diamond ball impressor point through a high duty weigher or pressure scale. The bulletin is illustrated.